
Archives of PHYSICAL MEDICINE

Official Journal American Congress of Physical Medicine
(Formerly Archives of Physical Therapy)



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VOLUME XXX

NOVEMBER, 1949

NO. 11

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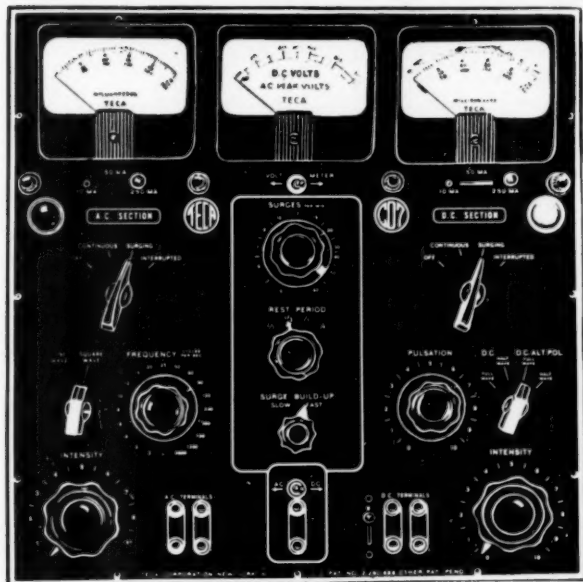
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Name and Location of School	Medical Director and Director Technician	Entrance Requirements	Duration of Course	Time of Admission	Maximum Enrollment	Tuition	Certificate, Diploma, Degree
Childrens Hospital, Los Angeles ¹	S. S. Mathews, M.D.	a-b	14 mos.	Sept	14		Cert. or Degree
College of Medical Evangelists, Los Angeles ¹	Fred B. Moor, M.D.	a-b-c	15 mos.	Sept	16	\$300	Cert. or Dipl.
University of Southern California, Los Angeles ^{1, 11}	R. William Berdan	a-b-c	14 mos.	Sept	20	\$594	Certificate
University of California Hospital, San Francisco ¹	Miss Charlotte W. Anderson	c-d-HS	1-4 yrs.	Sept-Feb		\$16 per unit	Cert. & Degree
Stanford University, Stanford University, Calif. ¹	Miss Margaret Warner	d	12 mos.	Sept	16	\$220 ¹²	Cert. or Degree
University of Colorado Medical Center, Denver ¹	W. H. Northway, M.D.	a-b-d	12 mos.	Varies	18	\$620	Cert. or Degree
Northwestern University Medical School, Chicago ¹	Miss Lucille Daniels	a-b-d	12 mos.	Sept	12	\$300 ¹³	Cert. or Degree
State University of Iowa Medical School, Iowa City ¹	Harold Drunken, M.D.	a-b-d	12 mos.	Oct	16	\$460	Certificate
University of Kansas School of Medicine, Kansas City ¹	Miss Mary Lawrence	a-b-d	12 mos.	Sept	15	\$200	Certificate
Bouvé-Boston School of Physical Education, Boston	John C. Connelley, M.D.	e	12 mos.	Sept	15	\$ 80 ¹⁴	Cert. or Degree
Simmons College, Boston	W. D. Paul, M.D.	a-b-d	12 mos.	Feb-Sept	15	\$560	Dipl. & Degree
Boston University College of Physical Education for Women, Sargent College, Cambridge, Mass.	Mrs. Olive Farr	H.S.	4 yrs.	Sept	28	\$560	Dipl. or Degree
University of Minnesota, Minneapolis ¹	Donald L. Rose, M.D.	H.S.-e	1½-4½ yrs.	Sept	30	\$450	Cert. or Degree
Mayo Clinic, Rochester, Minn. ¹	Mrs. Ruth G. Monroth	H.S.	4 yrs.	Sept	16	\$680 ¹⁵	Degree
Washington Univ. School of Medicine ¹	W. T. Green, M.D.	a-e	12 mos.	Sept	30	None	Certificate
St. Louis University School of Nursing, St. Louis ¹	Miss Janet B. Merrill	c	2 yrs.	Sept	13	\$400	Degree
Albany Hospital, Albany, N. Y.	Kenneth Christopher, M.D.	H.S.	4 yrs.	Jan-Sept	10	\$300	Degree
Columbia University College of Physicians and Surgeons, New York City ¹	Miss Adelaide McGarrett	a-b-d	12 mos.	Sept	6	\$250	Certificate
New York University School of Education, New York City ¹	Miss E. Knapp, M.D.	a-b-d	12 mos.	Sept	50	\$710	Cert. or Degree
Duke Hospital, Durham, N. C. ¹	Miss Helen Belknap	a-b-d	12 mos.	Sept	40	\$600	Cert. & Degree
D. T. Watson School of Physiatrists, Leedsdale, Pa. ¹	Sidney M. Ingham	a-b-d	12 mos.	Oct	13	\$500	Certificate
Graduate Hospital of the University of Pennsylvania, Philadelphia ¹	William B. Snow, M.D.	a-c-e	1-2 yrs.	Oct	30	\$300	Diploma
University of Texas School of Medicine, Galveston ¹	Miss Kathryn Kelley	a-b-d	12 mos.	Sept	20	\$400	Certificate
Hermann Hospital, Houston ¹	George G. Scarborough, D.	b-d	12 mos.	Jan	8	\$163 ¹⁶	Certificate
Baruch Center of Physical Medicine of the Medical College of Richmond, affiliation with Richmond Professional Institute, University of Wisconsin Medical School, Madison	Miss Catherine Graham	a-b-d	12 mos.	Oct	13	\$300	Diploma
Medical Department - U. S. Army - Medical Field Service School, Brooke Army Medical Center, San Antonio, Texas	Miss Floy Pinkerton	a-b-d	12 mos.	Sept	20	\$400	Certificate
Philadelpia General Hospital, Denver, Colorado	George G. Scarborough, D.	a-b-d	12 mos.	Oct	13	\$500	Certificate
Walter Reed General Hospital, Army Medical Center, Washington, D. C.	Lenox D. Baker, M.D.	a-b-d	12 mos.	Oct	30	\$300	Diploma
Permanent School of Physical Therapy, Oakland, Calif.	Miss Helen Kaiser	a-b-d	12 mos.	Oct	13	\$300	Cert. or Degree
Cleveland Clinic Hospital, Cleveland, Ohio	Jessie Wright, M.D.	a-b-d	12 mos.	Oct	13	\$300	Cert. or Degree
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	George G. Scarborough, D.	a-b-d	12 mos.	Oct	13	\$300	Cert. or Degree
	Miss Helen Kaiser	a-b-d	12 mos.	Oct	13	\$300	Cert. or Degree
	Jessie Wright, M.D.	a-b-d	12 mos.	Oct	13	\$300	Cert. or Degree
	Miss Kathryn Kelley	a-b-d	12 mos.	Oct	13	\$300	Cert. or Degree
	George G. Scarborough, D.	a-b-d	12 mos.	Oct	13	\$300	Cert. or Degree
	Miss Helen Kaiser	a-b-d	12 mos.	Oct	13	\$300	Cert. or Degree
	Jessie Wright, M.D.	a-b-d	12 mos.	Oct	13	\$300	Cert. or Degree
	Miss Kathryn Kelley	a-b-d	12 mos.	Oct	13	\$300	Cert. or Degree
	George G. Scarborough, D.	a-b-d	12 mos.	Oct	13	\$300	Cert. or Degree
	Miss Helen Kaiser	a-b-d	12 mos.	Oct	13	\$300	Cert. or Degree
	Jessie Wright, M.D.	a-b-d	12 mos.	Oct	13	\$300	Cert. or Degree
	Miss Kathryn Kelley	a-b-d	12 mos.	Oct	13	\$300	Cert. or Degree
	George G. Scarborough, D.	a-b-d	12 mos.	Oct	13	\$300	Cert. or Degree
	Miss Helen Kaiser	a-b-d	12 mos.	Oct	13	\$300	

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NOTE: The duration of the course is expressed in academic years.

Name and Location of School	College Affiliation	Duration of Course	Classes Start	Entrance Requirements	Tuition Per Year	Certificate, Diploma	Graduates in 1947
University of Southern California, 923 1/2 35th Place, Los Angeles	University of Southern California	2 yrs.	FebSept	Degree	\$420	Certificate	22
Mills College, Oakland, Calif.	Mills College	3 yrs.	FebSept	High sch.	\$450	Cert. & B.S.	---
San Jose State College, San Jose, Calif.	San Jose State College	1 1/2 yrs.	Varies	Degree	\$550	Certificate	10
University of Illinois College of Medicine, 1853 W. Polk St., Chicago	University of Illinois	5 yrs.	Feb	High sch.	\$152	B.S.	14
University of Iowa, Iowa City, Iowa	State University of Iowa	5 yrs.	.....	High sch.	\$ 85	Cert. & Deg.	10
University of Kansas, Lawrence	College of Medicine	2 yrs.	FebSept	Degree	\$131	Certificate	10
Boston School of Occupational Therapy, 7 Harcourt St., Boston	University of Kansas	4 yrs.	FebSept	High sch.	\$131	B.S.	13
Wayne University, 4841 Cass, Detroit, Mich.	Wayne University	5 yrs.	Sept	Degree	\$500	Diploma	13
Kalamazoo School of Occupational Therapy, Western Michigan College of Education, Kalamazoo	Wayne University	5 yrs.	Sept	High sch.	\$450	B.S.	20
Michigan State Normal College, Ypsilanti	Wayne University	4 yrs.	.....	Degree	\$127	Diploma	8
University of Minnesota, Church Street, Minneapolis	Wayne University	5 yrs.	.....	High sch.	\$118	Cert. & Deg.	4
College of St. Catherine, St. Paul, Minn.	University of Minnesota	3 1/2 yrs.	Varies	1 yr. coll.	\$210	Degree	10
Washington University School of Medicine, St. Louis	The College of St. Catherine	3 yrs.	Sept	2 yrs. coll.	\$400	Degree	6
University of New Hampshire, Durham	Washington University	5 yrs.	Sept	High sch.	\$160	Cert. & Deg.	28
Columbia University College of Physicians and Surgeons, 630 W. 168th St., New York City	Univ. of New Hampshire	1 1/2 yrs.	Sept	Degree	\$450	Certificate	20
New York University School of Education, 100 Washington Sq. E., New York City	Columbia University	2 1/2 yrs.	Sept	High sch.	\$500	Degree	21
Ohio State University, Columbus	New York University	1 1/2 yrs.	Quarterly	High sch.	\$105	Diploma	35
Philadelphia School of Occupational Therapy, 419 S. 19th St., Philadelphia	Ohio State University	3 yrs.	Sept	Degree	\$500	Diploma	13
Texas State College for Women, Denton, Tex.	University of Pennsylvania	5 yrs.	Sept	High sch.	\$600	Degree	20
Richmond Professional Institute, 901 W. Franklin St., Richmond, Va.	Texas State College for Women	1 1/2 yrs.	FebSept	High sch.	\$150	Cert. & Deg.	20
College of Puget Sound, Tacoma, Wash.	Medical College of Virginia	3 yrs.	Sept	Degree	\$200	Certificate	8
University of Wisconsin, Madison	College of Puget Sound	5 yrs.	FebSept	Degree	\$350	Cert. & Deg.	22
Milwaukee-Downer College, Dept. of Occupational Therapy, 2512 E. Hartford, Milwaukee	University of Wisconsin	4 yrs.	FebSept	High sch.	\$300	Cert. & Deg.	15
Mount Mary College, 2900 Menomonee River Dr., Milwaukee	Milwaukee-Downer College	2 1/2 yrs.	Sept	1 yr. coll.	\$300	Diploma	110
University of Toronto, Dept. of University Extension, Toronto, Ont., Canada	Milwaukee-Downer College	4 yrs.	Sept	High sch.	\$335	Certificate	15
Colorado Agricultural and Mechanical College, Fort Collins, Colorado	University of Toronto	5 yrs.	Sept	Degree	\$260	B.S. Deg.	110
		3 yrs.	Sept	High sch.	\$222	Diploma	
		5 yrs.	Sept	High sch.	B.S.	

* Rep. in part J. A. M. A. 127:1460 (Aug.) 1948.

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EFFECT OF HOT FOMENTS ON VOLUME OF BLOOD FLOW IN EXTREMITIES OF DOGS*

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and

H. M. HINES, Ph.D.

IOWA CITY

For the past several years there has been an increased use of hot fomentations in the treatment of acute poliomyelitis and other neuromuscular disorders. The application of moist heat was found to be effective for reducing pain and discomfort and for lessening hypertonicity and spasm in skeletal muscle during the acute stages of poliomyelitis. According to the Kenny concept of infantile paralysis,¹ treatment with hot fomentations reduces the extent and duration of muscle spasm and thereby lessens the incidence of permanent shortening, fibrosis and eventual contracture in the affected muscles.

Even though this modality of treatment has been widely employed and many accounts of its effectiveness have appeared, there is a dearth of information concerning the basic mechanisms involved in its *modus operandi*. It has been generally assumed that afferent impulses from the areas to which hot fomentations are applied serve to reduce the hypertonicity and spasm in muscle. An idea has been advanced¹ that the hot fomentations cause an increased circulation in skeletal muscle and that a degree of ischemia with resulting anoxia is present in muscle when in a state of spasm. However, Hall and co-workers² demonstrated that the application of hot fomentations to the flexor muscles of the human forearm diminished the strength of voluntary contractions in that muscle group and that the application of hot fomentations reduced the contraction of the gastrocnemius muscles of anesthetized cats.³ It was suggested that the diminished neuromuscular responses might be due to a reflex vasoconstriction in the muscles.

Methods

The present study is concerned with the effects of hot foment applications upon the volume of blood flow in the extremities of dogs. Continuous recordings of the volume of blood flow in the femoral artery of dogs under nembutal anesthesia and with the use of heparin as an anticoagulant were made by means of an electromagnetic flowmeter.⁴ This technic requires that a small glass cannula, in which two electrodes are imbedded, be inserted into the femoral artery and fitted between the poles of a magnet. The electromotive force (EMF) which is generated when the flowing blood traverses the imposed magnetic field is amplified and recorded on an Esterline-Angus recorder. Each cannula was carefully selected as to bore and calibrated by measuring the volume of blood flow from the artery below the cannula into a graduated cylinder. The directly measured volume of blood flow was plotted against the EMF generated between the electrodes of the cannula. The calibration was considered to have an

* From the Department of Physiology, College of Medicine, State University of Iowa.

¹ This work was aided by a grant from The National Foundation for Infantile Paralysis, Inc.

² Read at the Twenty-Seventh Session of the American Congress of Physical Medicine, Cincinnati, Sept. 10, 1949.

1. Pohl, J. H., and Kenny, E.: *The Kenny Concept of Infantile Paralysis and Its Treatment*, Minneapolis, Bruce Publishing Company, 1943.

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error of less than 5 per cent and showed a linear relation to exist between volume of flow and EMF generated.

The packs, pieces of Munsingwear, were wrung out from water which was maintained at a temperature between 70 and 75 C. The pack was then wrapped around the hindlimb of the dog over the gastrocnemius muscle. A piece of oil silk and then blanketing material were wrapped over the hot pack. The temperature of the hot pack was measured by the insertion of a mercury thermometer into the pack. The temperature changes due to the application of the hot foment were measured by means of an iron-constantan thermocouple needle which was inserted into the subcutaneous tissue over the belly of the gastrocnemius muscle. The potentials were read every minute on a Leeds-Northrup potentiometer. Control values for blood flow were taken for fifteen minutes before the hot pack was applied. After removing the pack, the blood flow was followed until it had returned to the control level. Blood pressures and heart rates were recorded to determine whether either could be responsible in part for any changes in the volume of blood flow which might be produced as a result of hot foment applications. The blood pressures were measured on a Brush recorder from a Statham strain gauge equipped with a needle which was inserted into an artery. Heart rates were measured from the blood flow records which were obtained when the Esterline-Angus recorder was set at a fast speed.

Since it had been postulated that hot foment are effective, in part, through reflex mechanism, it was decided to investigate their relative effectiveness upon blood flow in denervated limbs and upon limbs in which the skin was anesthetized with Butesin (butyl aminobenzoate U. S. P.). Denervation was accomplished by severing both the sciatic and the femoral nerves. The studies to be reported on 4 dogs were made at seven to eleven days after operation. A 3 per cent solution of Butesin in sesame oil was used as a local anesthetic in experiments on 4 dogs. The Butesin solution was painted on the shaven skin of the hindlimb. After five minutes the excess oil was wiped off and a second application made. This procedure was repeated three times and, at the end of the fifteen minute period of control flow, the hot packs were then applied.

Results

In the first group of experiments performed on 7 dogs it was found that the application of a single hot pack which was allowed to remain in place for five minutes caused an average increase of 5.4 degrees C. in the temperature of the subcutaneous tissue but only a slight or inconsistent increase in blood flow (chart 1). The initial temperature of the packs ranged from 49 to 54

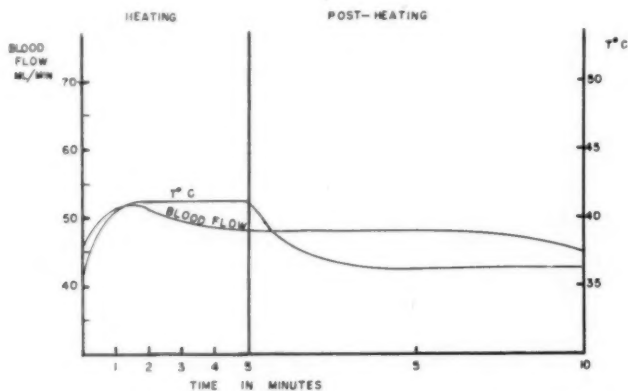


Chart 1. — Changes in temperature and blood flow in the limb of dogs caused by the application of a single hot pack.

C. and at the time of removal five minutes later they had cooled to between 43 and 44 degrees C.

In a second group of experiments performed on 7 dogs it was found that the application of three consecutive hot packs caused a marked increase

in the volume of blood flow through the treated limb (chart 2). The method of applying the hot packs was the same as that described for the first series except that the first and second packs were replaced after having been in place for two minutes and the third pack was left in place for five minutes so that the total heating time was nine minutes. The rate of blood flow increased gradually from the time the hot pack was applied up to maximum

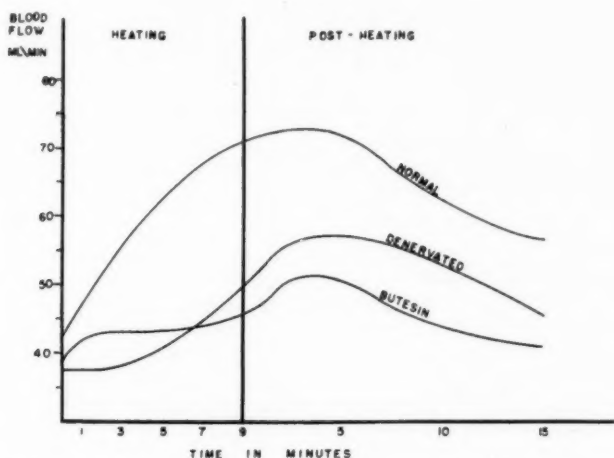


Chart 2. — The effect of the application of hot packs on blood flow in the hindlimbs of dogs under various experimental conditions.

which was reached the second minute after the third pack had been removed. It took from twenty to forty minutes after the final pack had been removed before the blood flow returned to control values. The maximum average subcutaneous temperature increase was 8.8 degrees C. and this was attained during the fifth minute of heating. After this the temperature gradually decreased, although the blood flow continued to increase for some time. It took from twenty to forty minutes after the final pack had been removed for the blood flow to return to control levels.

The application of three consecutive hot packs to denervated limbs caused considerably less increase in blood flow than that found under similar conditions in normal innervated limbs (chart 2). The increase in blood flow did not begin until approximately three minutes after the pack was applied and reached a maximum level at approximately two minutes after the pack had been removed. The average subcutaneous temperature changes followed the pattern which was found in normal limbs.

The volume of blood flow in the limbs to which Butesin had been applied showed a slight increase during and after the application of three consecutive hot packs. However, the increase was much less than that found when hot fomentations were applied to normal limbs (chart 2). Again, the average subcutaneous temperature changes were comparable to those found in the normally innervated limb without local anesthesia (table 1). The arterial blood pressures and heart rates did not change with the application of hot fomentations. This finding suggests that vasodilation in the limb was responsible for the increased volume of blood flow.

Average Values for the Effect of the Application of Hot Packs Upon the Subcutaneous Temperature in the Hindlimbs of Dogs Under Various Experimental Conditions.

	Normal Limb, °C.	Denervated Limb, °C.	Butesin Anesthesia, °C.
Control	35.5	36.9	36.2
Heating, minutes —			
1	40.0	41.1	39.4
3	43.1	44.2	42.7
5	44.3	44.8	43.9
7	43.7	44.1	43.3
9	42.6	42.5	42.7
Postheating, minutes —			
1	39.5	38.8	39.6
2	37.4	37.9	37.9
5	35.9	37.5	36.9

Comment

The effectiveness of hot fomentations in increasing the volume of blood flow through a normally innervated extremity appears to be related to the amount of hyperthermia produced. Only a very slight increase was found when a single pack was applied, but when a series of three consecutive packs were used there was an average increase of 68 per cent in the volume of blood flow. The subcutaneous temperatures averaged 3 degrees higher in the latter case. However, it seems highly possible that greater increases in blood flow might result when comparable treatments are applied to the limbs of unanesthetized human subjects. The effect of hot packs was less pronounced in both the denervated extremity and those to which Butesin anesthesia had been applied. These observations would indicate that the increased blood flow following the application of hot moist packs is produced, at least in part, by a reflex mechanism. The finding of an increased blood flow in the extremity during the application of hot fomentations is evidence against the assumption³ that the decrease in muscle strength which occurs during this treatment is due to the effects of vasoconstriction.

Conclusions

1. Hot moist packs are effective in augmenting the rate of blood flow through the extremities of anesthetized dogs if sufficient hyperthermia is produced.
2. The mechanism for producing increased blood flow by means of application of hot packs may be in part reflex, since both denervation and Butesin anesthesia appear to diminish the effectiveness of this thermogenic agent.



A COMPARATIVE STUDY OF THE HEATING OF TISSUES BY NEAR AND FAR INFRARED RADIATION *

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It has been widely accepted that near infrared radiation is more efficient in penetrating and heating human tissues than far infrared radiation.¹ Studies on the transmission of heat energy through the human skin have supplied most of the evidence for this idea.

Bachem and Reed² isolated different spectral ranges by means of filters and determined the amount of energy which passed through various thicknesses of skin. They obtained the skin slices by the blister method. With a skin thickness of 2.5 mm., the greatest transmission of the incident energy occurred at wavelengths of 0.75 and 1.0 micron, with 20 per cent and 17 per cent transmission, respectively. With wavelengths longer than 1.4 microns, there was practically no penetration of the skin.

By using a 500 watt bulb as a source of light and a vacuum thermocouple for measuring the energy radiation, Cartwright,³ found that transmission through the cheek (thickness of 5 mm.) was greatest at a wavelength of 1.1 microns. With a strip of skin 0.8 mm. thick, Gaertner⁴ obtained maximal transmission between the wavelengths of 0.8 and 1.5 microns (37 to 44 per cent transmission).

Hardy and Muschenheim⁵ studied the transmission through a skin thickness of 1.4 mm. There was a sudden decrease in transmission from 11 per cent at 1.3 microns to 2 per cent at 1.5 microns, followed by a slight increase in transmission to 7.5 per cent at approximately 1.8 microns. At longer wavelengths transmission was slight. Similar findings were reported by Henschke.⁶

* Read at the Twenty-Seventh Annual Session of the American Congress of Physical Medicine, Cincinnati, Sept. 8, 1949.

1. Elkins, E. C., and Sheard, Charles: The Effect of Infrared Irradiation on Cutaneous Temperatures, *Arch. Phys. Therapy*, 22:476 (Aug.) 1941. Krusen, F. H.: Physical Medicine: the Employment of Physical Agents for Diagnosis and Therapy, Philadelphia, W. B. Saunders Company, 1941, pp. 185-186; 201-207. Osborne, S. L., and Holmquest, H. J.: *Technic of Electrotherapy and Its Physical and Physiological Basis*, Springfield, Ill. Charles C Thomas, Publisher, 1944, pp. 194-224.

2. Bachem, A., and Reed, C. I.: Penetration of Light Through Human Skin, *Am. J. Physiol.* 97:86 (Apr.) 1931.

3. Cartwright, C. H.: Infra-Red Transmission of the Flesh, *J. Optic. Soc. America* 20:81 (Feb.) 1930.

4. Gaertner, Otto: Die Durchlässigkeit der menschlichen Haut im Gebiete von 0, 3-2, 0 μ , *Strahlentherapie* 40:377, 1931.

5. (a) Hardy, J. D., and Muschenheim, Carl: The Radiation of Heat from the Human Body: IV. The Emission, Reflection, and Transmission of Infra-Red Radiation by the Human Skin, *J. Clin. Investigation* 13:817 (Sept.) 1934; (b) Radiation of Heat from the Human Body: V. The Transmission of Infrared Radiation Through Skin, *ibid.* 18:1 (Jan.) 1936.

6. Henschke, U.: Biologische und physikalische Grundlagen der Rot- und Ultrarotstrahlentherapie, *Strahlentherapie* 66:846, 1939.

A comparison between far and near infrared radiation was also made by determining their effect on tissue temperatures. Loewy and Dorno⁷ obtained higher skin temperatures with far infrared rays and higher deep temperatures with near infrared rays. However, this study was made on only a few subjects, and the dosage was varied considerably — namely, 1.61 to 2.47 gram-calories per square centimeter per minute for the far infrared radiation and 3.76 gram-calories per square centimeter per minute for the near infrared radiation.

Sonne⁸ noted that a subject could tolerate more energy in the near than in the far infrared zone without burning. By using the "strongest possible irradiation," he obtained skin temperatures of 43.8 C. with the near infrared radiation and 45.5 C. with the far infrared. In another series of experiments, in which the dosage was not stated, the skin temperature reached 44.3 C. after irradiation with near infrared rays and 43.7 C. when far infrared rays were used; the deep temperatures, however, were 41.7 and 40.5 C., respectively.

Henschke⁶ used the maximal tolerated dose in irradiating his subjects. Higher skin temperatures were obtained with far infrared radiation, higher subcutaneous temperatures with near infrared radiation and approximately the same muscle temperatures with the two types. He concluded that the greatest rise of temperature occurred when the wavelength was between 0.7 and 1.3 microns.

When one correlates the degree of absorption with the wavelength, certain difficulties arise in accepting without reservation the conclusions made from the foregoing findings. For conductors, reflection of incident radiation increases with the frequency.⁹ That this applies to human tissue too has been shown by Hardy and Muschenheim,¹⁰ by Henschke⁶ and by Sonne.⁸ At a wavelength of 1.0 micron (in the near infrared range), as much as 50 per cent of the incident energy may be reflected.

It has been generally assumed that the ineffectiveness of far infrared radiation is due to its absorption by a skin surface which acts as a black body at these wavelengths. Yet there is some evidence¹⁰ that the skin is not a perfect black body. This, of course, needs to be confirmed by further work.

It is difficult to compare the effects of irradiation with infrared rays of different wavelengths by the use of only a skin slice for the study of transmission. Inanimate tissues may not have transmission properties which are identical with those of living tissues. Finally, corresponding dosages have not been rigorously adhered to in comparing the near and far rays. Laurens and Foster¹¹ observed that the shorter waves caused less discomfort, but they stated that "it is possible to heat deeper tissues as high with long waved infrared as with short."

In the face of the existing contradictory evidence, it was deemed desirable to compare the energy absorption by human tissues of practically identical outputs of energy in the far and in the near infrared range.

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8. Sonne, Carl: Investigations on the Action of Luminous Rays and Their Mode of Action, *Arch. Phys. Therapy* 10:93 (Mar.) 1929.

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Methods

The source of the near infrared radiation was a CX Mazda, 250 watt bulb operated at 110 volts. The maximal output of energy for this bulb occurred at approximately 1.0 micron. The far infrared radiation was provided by a 450 watt carborundum heater, with the maximal output at approximately 4 to 5 microns. The carborundum heater was operated at 102 to 106 volts. During each experiment the voltage was kept at a constant level by means of a voltage regulator.

The pattern of energy emission from these two sources of heat was studied by means of a radiation thermocouple. The thermocouple had been calibrated with a standard bulb so that a galvanometer deflection of 1 cm. was equivalent to a radiant flux density of 3,060 microwatts per square centimeter (or 732×10^{-6} gram-calorie square centimeter per second).

Fifty-eight observations were made on 10 normal male subjects. The temperatures of the skin, subcutaneous tissue and muscle were taken by means of copper-constantan thermocouples. After a stable temperature had been reached, the volar surface of the forearm was irradiated while the recording elements of the thermocouples were in the zone of maximal energy emission, as determined from the heating pattern. In half of the observations there was a fifteen minute heating period, and temperatures of the skin, subcutaneous tissue and muscle (at a depth of 10 mm.) were recorded every minute. Tissue temperatures were also taken for five minutes after the fifteen minute heating period was over. During the first minute after irradiation was stopped, tissue temperatures were recorded at fifteen second intervals. For the next four minutes temperatures were taken at one minute intervals. In the other half of the observations the period of heating was one minute, with temperatures recorded at the surface and at depths of 5, 10 and 15 mm.

There were three groups of observations. In group A (20 observations) the CX Mazda, 250 watt bulb was the source of heat. The distance from the bulb to the skin was 31.5 cm., and the radiant flux density striking the surface of the skin was 0.153 watt per square centimeter (or 2.20 gram-calories per square centimeter per minute). In group B (18 observations) the carborundum heater was used, with an energy output similar to that of the Mazda bulb. The distance from the heater to the skin was 30 cm., and the average radiant flux density was 0.152 watt per square centimeter (2.18 gram-calories per square centimeter per minute).

After these two series of experiments were completed, a third series was performed with the carborundum heater moved farther away from the skin so that the rise of cutaneous temperature for the Mazda bulb and the carborundum heater would be approximately the same. In group C (20 observations) the distance from heater to skin was 40 cm., and the average radiant flux density striking the surface of the skin was 0.0859 watt per square centimeter (1.23 gram-calories per square centimeter per minute). To 4 subjects in this group the heating was given for a period of thirty minutes. During the last fifteen minutes of this thirty minute period tissue temperatures were taken at five minute intervals.

Results

Group A. (Mazda bulb; 2.20 gram-calories per square centimeter per minute), (table 1; figure 1). — On the average, the cutaneous and subcutaneous temperatures rose during the first five minutes of heating and then remained fairly constant for the rest of the heating period. During this period of heating (five to fifteen minutes), when the cutaneous and subcutaneous temperatures were at a steady level, the average rise of cutaneous temperature was between 8.3 and 8.5 degrees C., while the average rise of subcutaneous temperature was between 7.3 and 7.6 degrees C. The muscle temperature (depth of 1.0 cm.) continued to rise slowly during the entire fifteen minute period of heating, finally reaching an average increase of 4.2 degrees C.

Group B. (Carborundum heater; 2.18 gram-calories per square centimeter per minute), (table 1; figure 2). — The plateauing of the heating curves for skin and subcutaneous tissues occurred after approximately four to five minutes of heating. The average rise of cutaneous temperature after constant temperature had been reached was between 10.3 and 10.6 degrees C., while the average rise of subcutaneous temperature was between 6.9 and 7.3

TABLE 1. — Comparison of the Rise of Cutaneous, Subcutaneous and Muscle (10 mm. Depth) Temperature After Exposure to Near and Far Infrared Radiation.

Source	Energy,* Gm. Cal./ CM. ² /Min.	Tissue	Control Temp. °C.	Rise of Temperature in Degrees C. over the Control														
				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Mazda	2.20	Skin	33.5	5.3	7.3	7.8	8.1	8.3	8.3	8.4	8.5	8.3	8.3	8.3	8.3	8.3	8.4	8.4
Carbo- rundum	2.18	Skin	33.4	7.3	9.5	10.2	10.4	10.4	10.3	10.6	10.5	10.4	10.5	10.3	10.6	10.4	10.5	10.6
Carbo- rundum	1.23	Skin	33.4	4.2	6.1	7.3	7.6	7.5	8.0	8.0	8.1	8.2	8.1	8.2	8.2	8.2	8.2	8.1
Mazda	2.20	Subcu- taneous	33.9	4.0	6.0	6.7	7.1	7.4	7.4	7.5	7.6	7.5	7.4	7.3	7.4	7.4	7.4	7.5
Carbo- rundum	2.18	Subcu- taneous	33.9	4.4	6.0	6.7	6.9	7.0	7.0	7.2	7.2	7.2	7.2	7.2	7.3	7.2	7.2	7.2
Carbo- rundum	1.23	Subcu- taneous	33.8	2.9	4.2	4.9	5.3	5.6	5.8	5.9	6.0	6.0	6.1	6.1	6.2	6.1	6.2	6.1
Mazda	2.20	Muscle	34.6	0.7	1.4	1.9	2.4	2.8	3.0	3.3	3.5	3.6	3.8	3.8	3.9	4.0	4.1	4.2
Carbo- rundum	2.18	Muscle	34.6	0.8	1.7	2.5	3.0	3.3	3.5	3.7	3.8	3.9	4.1	4.2	4.3	4.3	4.4	4.4
Carbo- rundum	1.23	Muscle	34.4	0.6	1.1	1.6	2.0	2.3	2.6	2.9	3.0	3.1	3.3	3.4	3.6	3.6	3.7	3.8
Time in minutes after heating				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

* Radiant flux density at skin surface.

degrees C. The muscle temperature curve resembled that produced by exposure to the Mazda bulb, and the temperature continued to rise during the entire fifteen minute period of heating, reaching an average increase in temperature of 4.4 C. at the end of fifteen minutes (table 1). The amount of energy used in this group was in the region of the maximal tolerated dose

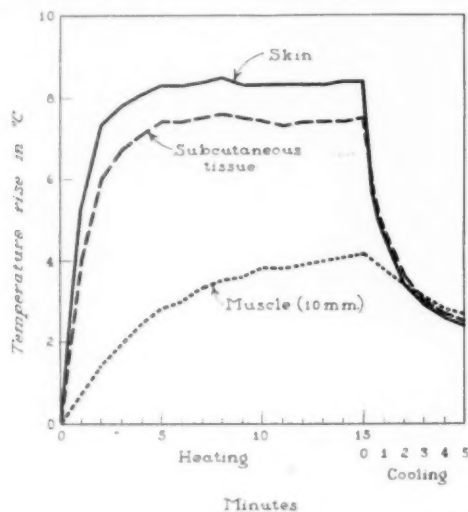


Fig. 1. — Heating and cooling curves of skin, subcutaneous tissue and muscle (10 mm. depth), after exposure to a 250 watt CX Mazda bulb with radiant flux density of 2.20 Gm. cal./cm.²/min. at skin surface. Each point is the average of 10 observations.

for the carborundum unit. In fact, in 1 case a superficial burn resulted. The data for this observation were not included, for the irradiation was not continued for fifteen minutes.

Group C. (Carborundum heater; 1.23 gram-calories per square centimeter per minute), (table 1; figure 3). — The plateauing of the cutaneous and subcutaneous heating curves did not occur till after approximately six to eight minutes of heating. After this period, the average rise of cutaneous

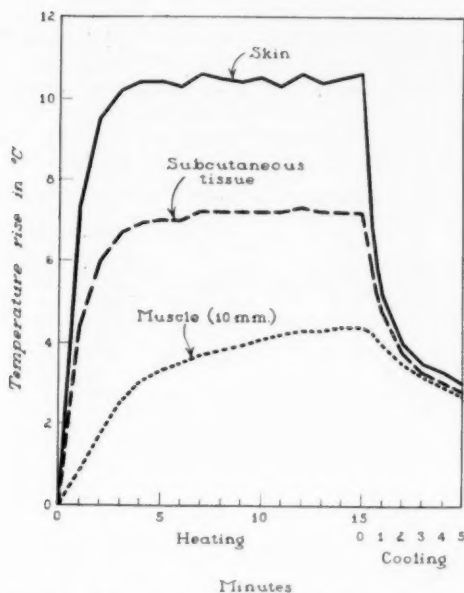


Fig. 2. — Heating and cooling curves of skin, subcutaneous tissue and muscle (10 mm. depth) after exposure to a carbundum heater with a radiant flux density of 2.18 Gm. cal./cm.²/min. at skin surface. Each point is the average of 9 observations.

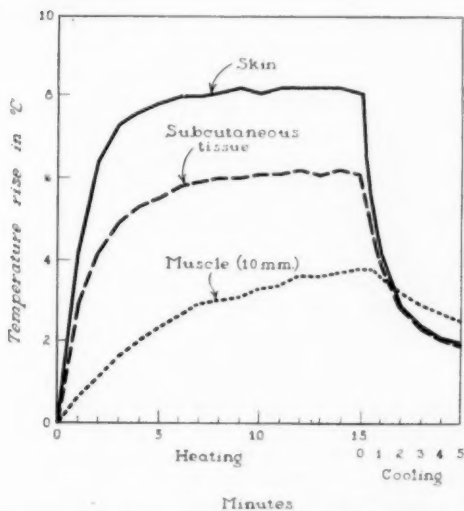


Fig. 3. — Heating and cooling curves of skin, subcutaneous tissue and muscle (10 mm. depth), after exposure to a carbundum heater with a radiant flux density of 1.23 Gm. cal./cm.²/min. at skin surface. Each point is the average of 10 observations.

temperature was between 8.0 and 8.2 degrees C., while the average rise of subcutaneous temperature was between 6.0 and 6.2 degrees C. The temperature of the muscle continued to rise during the entire period of heating, and at the end of the fifteen minutes reached an average increase of 3.8 degrees C. over the control. Four subjects in this group were irradiated for thirty minutes. There was no significant change in the temperature level of the tissues during the additional fifteen minutes of heating.

TABLE 2. — *Temperature Rise Over Control After One Minute of Heating.*

Source	Energy,* Gm. Cal./Cm. ² /Min.	Temperature Rise, Degrees C.				
		Skin	Subcutaneous Tissue	Muscle (5 Mm. Depth)	Muscle (10 Mm. Depth)	Muscle (15 Mm. Depth)
Mazda	2.20	5.35	4.00	2.40	0.70	0.21
Carborundum	2.18	7.35	4.40	3.10	0.80	0.25
Carborundum	1.23	4.20	2.90	1.70	0.60	0.20

* Radiant flux density at skin surface.

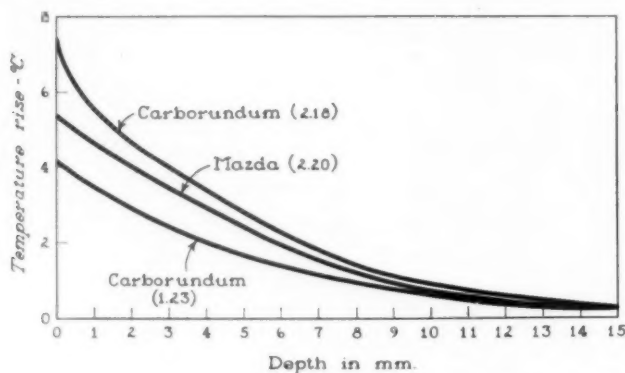


FIG. 4. — Average temperature rise in tissues at various depths after one minute of heating. Figures in parentheses represent radiant flux density in Gm. cal./cm.²/min. at skin surface.

The average rise of temperature of the tissues after exposure to the source of heat for only one minute is indicated in table 2 (figure 4). At all levels studied (from the surface to a depth of 15 mm.) the greatest rise of temperature occurred after exposure to the carborundum heater with a radiant flux density at the skin surface of 2.18 gram-calories per square centimeter per minute, and the smallest rise of temperature occurred after exposure to the carborundum heater with a radiant flux density of 1.23 gram-calories per square centimeter per minute.

Comment

From figure 5a, b and c, a comparison may be made between the two heat sources. When the radiant flux density at the skin surface from the two sources is approximately the same, the carborundum heater produces a much greater rise of cutaneous temperature and a slightly but yet significantly greater rise of muscle temperature (at a depth of 10 mm.) than does the Mazda bulb. The rise in subcutaneous temperature is approximately the same for the two sources of heat.

When the radiant flux density at the skin surface from the carborundum

heater was decreased by increasing the distance between the source of heat and the skin, the rise of cutaneous and muscle temperatures was only slightly smaller than with the Mazda bulb, whereas the rise of subcutaneous temperature was much less than with the Mazda bulb.

On the basis of a comparison of the heating curves in chart 5, it seems that the energy absorption by the tissues is greater with the carborundum

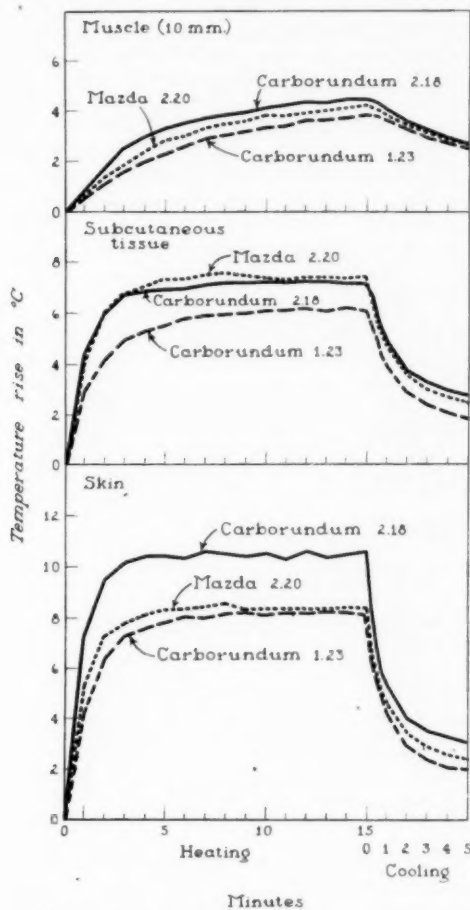


Fig. 5. — Comparison of the rise in temperature of (a) the skin, (b) the subcutaneous tissue and (c) the muscle (depth of 10 mm.) produced by the different sources of heat. The figures after the sources represent the radiant flux density in $\text{Gm. cal./cm}^2/\text{min.}$ at skin surface.

heater than with the Mazda bulb. To compare more accurately the energy absorption by the tissues after exposure to near and far infrared radiation, the temperature rise at different depths was studied after a one minute period of heating (figure 4). The one minute heating period was chosen in order to minimize the effect of the circulation and to decrease the amount

of heat conducted through the tissues. In calculating the energy absorption by a unit volume of tissue the following assumptions were made: The specific heat of skin is 0.7, of subcutaneous tissue is 0.5 and of muscle is 0.8; the thickness of the cutaneous and subcutaneous layers is approximately 2 mm. each. A planimeter was used to determine the area under the curve and from that the average rise in temperature of each tissue. For the muscle it was not deemed necessary to go deeper than 15 mm., since the rise of

TABLE 3. — *Comparison of Energy Absorption by Skin, Subcutaneous Tissue and Muscle (15 mm. Depth) After Exposure to Near and Far Infrared Radiation.*

Source	Energy Output,* Gm.-Cal./Cm. ² /Min.	Average Temperature Rise × Specific Heat			Relative Total Energy Absorption	Per Cent of Total Energy Absorbed by		
		Skin	Sub- cutaneous Tissue	Muscle		Skin	Sub- cutaneous Tissue	Muscle
Mazda bulb	2.20	3.21	1.70	0.82	5.73	56.0	29.7	14.3
Carborundum	2.18	3.92	1.99	1.07	6.98	56.1	28.5	15.4
Carborundum	1.23	2.33	1.18	0.62	4.13	56.4	28.6	15.0

* Radiant flux density at skin surface.

temperature at this depth was essentially the same for all three groups. The energy absorption per unit volume of tissue was then obtained by taking the product of the average temperature rise and the specific heat of the tissue (table 3).

In table 4 the radiant flux density at the skin surface from the sources of heat and the energy absorbed by the tissues are compared. When the radiant flux density from the carborundum heater is 2.18 gram-calories per

TABLE 4. — *Comparison of the Radiant Flux Density at the Skin Surface and the Energy Absorption by the Tissues.*

Sources Compared	Comparison of Radiant Flux Density at the Skin Surface	Comparison of Energy Absorption by Tissues
Carborundum (2.18)* and Mazda (2.20)	Carborundum 0.9% less than Mazda	Carborundum 22% greater than Mazda
Carborundum (1.23) and Mazda (2.20)	Carborundum 44% less than Mazda	Carborundum 28% less than Mazda
Carborundum (2.18) and carborundum (1.23)	Carborundum (1.23) 43.5% less than carborundum (2.18)	Carborundum (1.23) 40.8% less than carborundum (2.18)

* Figures in parentheses refer to radiant flux density at the skin surface in Gm. cal./cm.²/min.

square centimeter per minute, the energy absorbed by the tissues is 22 per cent greater than with exposure to the Mazda bulb, even though the radiant flux density at the skin surface is almost identical. When the carborundum output is 44 per cent less than the Mazda bulb output, the energy absorption by the tissues is only 28 per cent smaller with the carborundum heater than with the Mazda bulb. In each case the energy absorption by the tissues after exposure to the carborundum unit is greater than one would expect were the tissues to respond to the two sources of heat in a similar fashion. This is further substantiated by comparing the carborundum heater at 2.18 with the same unit at 1.23 gram-calories per square centimeter per minute. When the energy reaching the skin is decreased by 43.5 per cent, the energy absorption is decreased by approximately the same amount — namely, 40.8

per cent — indicating that when the same heater is used the energy absorbed is directly proportional to the energy reaching the skin. The distribution of the energy absorbed is approximately the same in all three groups (last three columns, table 3), indicating that the results obtained are not due to unusual cutaneous heating with relatively little deep heating following exposure to the carborundum heater.

Equilibrium between heat absorption and heat dissipation is reached relatively quickly in the skin and subcutaneous tissues. In the muscle, however, more heat is received than is dissipated during the entire fifteen minute period of irradiation. From the few observations with thirty minutes of heating, it is evident that in no instance was the circulation sufficiently great to cope with large amounts of heat energy absorbed and thus cause a decrease in the temperature of the tissues.

The reasons for the discrepancy between these results and those reported previously are not apparent. It may be that skin slices and the intact skin do not have the same properties as far as transmission of infrared rays is concerned. The skin, however, may absorb and stop the transmission of the far infrared radiation, as implied by other authors, and then may serve as a source of energy conducting heat to the subcutaneous tissues and muscle.

Summary

The increase of cutaneous, subcutaneous and muscle temperatures was studied after exposure to sources of energy in the near and in the far infrared range. Near infrared rays were produced by a 250 watt Mazda bulb, and the far, by a carborundum heater (450 watts).

For both sources of heat, the skin absorbed the greatest amount of energy and the muscle the least, per unit volume of tissue.

During the period of exposure, there was no decrease in the temperature of the tissues from the maximal values reached, indicating that circulatory cooling factors had not coped with the accumulating heat energy in the tissues.

A STUDY OF THE EFFECT OF HYPNOTIC SUGGESTION ON PHYSIOLOGIC PERFORMANCE *

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and

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One of the announced objectives of the Baruch Committee of Physical Medicine when first organized was the determination of the suggestion value of physical treatment. It occurred to us that a basic approach to this subject would be to study the effect of hypnosis on certain types of exercise capable of precise control and quantitative evaluation. A study of the literature indicated that such an investigation has never been carried out with adequate numbers of subjects, suitable controls and appropriate statistical analysis of the results.

Hull¹ reviewed the subject up to 1933, noting shortcomings of the various studies chronicled. One of the first studies on physical performance under hypnosis was that of Nicholson.² Using the Mosso ergograph and 7 subjects, he determined that work done under hypnosis was much greater than in the normal state and that evidences of fatigue were absent following work under hypnosis. Williams,³ with slightly better controls and method, confirmed Nicholson's finding of increased work during trance but disagreed on fatigue. He found a great variability in the amount of increased work from subject to subject. Hadfield's (cited by Hull¹) subjects showed increased strength on the grip dynamometer. Young⁴ found that average grip was the same in the trance and in the normal state. An interesting approach was made by Nemtsova and Shatenshteyn.⁵ The Russian investigators, using very few subjects, determined oxygen consumption and oxygen debt on subjects carrying out measured work on the bicycle ergometer or lifting weights against gravity. During trance the subject was given the suggestion that he was doing very heavy work when, in fact, it was light, and vice versa. Changes in oxygen consumption, pulse rate and even chronaxia corresponded with the subject's belief rather than with his actual physical state. Wells⁶ obtained similar results with the grip dynamometer, the subject's performance being dissociated from his beliefs.

More recently, Eysenck⁷ used a battery of about thirty tests on just 2 subjects. He was interested in determining which type of test is most appropriate. He concluded that strength tests and any test involving fatigue seemed to show increased performance under hypnosis.

* From the Division of Physical Medicine and The Department of Anatomy, Washington University School of Medicine.

* Read at the Twenty-Seventh Annual Session of the American Congress of Physical Medicine, Cincinnati, Ohio, Sept. 8, 1949.

1. Hull, C. L.: *Hypnosis and Suggestibility: An Experimental Approach*, New York, D. Appleton-Century Company, 1933.

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3. Williams, G. W.: *The Effect of Hypnosis on Muscular Fatigue*, *J. Abnormal and Social Psychol.*, **24**:318, 1929.

4. Young, P. C.: *An Experimental Study of Mental and Physical Functions in the Normal and Hypnotic States*, *Am. J. Psychol.*, **36**:214, 1925.

5. Nemtsova, O. L., and Shatenshteyn, D. I.: *Effect of Hypnotic Suggestion on Certain Physiologic Processes Connected With Work*, *Fiziol. Zhur.*, **20**:581, 1936.

6. Wells, W. R.: *Expectancy Versus Performance in Hypnosis*, *J. Gen. Psychol.*, **35**:99, 1946.

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In addition to this material on physiology, there has been extensive work on memory for rote syllables, time estimation, crime production, etc., in the psychological literature. On the sensory side, no doubt whatever exists concerning the numerous well documented instances of major surgical procedures and childbirths being carried out under hypnotic anesthesia.

The purpose of our investigation was to repeat some of this experimental work, using every possible precaution to avoid the errors made by previous investigators. Since their experiments point in general to two main types of performance tests likely to show changes under hypnosis — dynamometric strength tests and fatigue tests — we determined to use these two types only. In order to facilitate analysis of results by statistical methods, we assembled the largest number of test subjects obtainable, 11 in all.

Method

We determined to eliminate every possible error of procedure and interpretation noted in previous work, in accord with the following principles:

We strove to eliminate every conceivable variable except the trance state itself. Each subject was his own control. Only those subjects achieving amnesic somnambulism were used in the final results. Criteria for depth of trance are noted later. To maintain consistency of directions, we used stereotyped instructions which were read word for word from a typed card during the control tests as well as during trance. These directions suggested to the subject that he was very strong and could make a high record. The same person performed all the dynamometric tests and recorded readings. In order to prevent the subjects from unconsciously cooperating by doing less than their best during the control periods, we did not tell them the purpose of the experiment. Not one was able to recall having repeated them during trance. For reliability of the dynamometric tests, we consulted Duvall, Houtz and Hellebrandt.⁸ Statistical study of our results confirms their findings. We used two types, the Martin arm type (fig. 1) and the grip type (fig. 2). In order to insure a rigid pattern of conformity in the former test we had the subject sit against a back rest always at the same angle with the arms bound to the sides by a webbing band. The head remained at all times against the rest. The elbow was held at a 90 degree angle in supination, with the dynamometer attached by a broad band around the wrist. A reset device registered the maximum pull as the operator "broke" the elbow flexors by steadily increasing downward pull. Three trials were recorded in both control and trance states for all eleven subjects. The quadratic mean of these intercorrelations was $r = 0.66$ for the normal and $r = 0.94$ for trance. A single reading only was recorded for the grip test.

To study fatigue we used a new test, first suggested by Schwab,⁹ who employs it in evaluating drugs in myasthenia gravis. The test (fig. 3) is exceedingly simple. The subject takes hold of the top bar of a set of stall bars, or any convenient trapeze or water pipe. He is told to disregard pain, which is not severe. When ready he gives a signal and kicks away the support under his feet. The experimenter starts a stopwatch. When the subject's fingers slip involuntarily off the bar the watch is stopped and the total seconds recorded. It was necessary to determine the reliability coefficient of this new endurance test. For this purpose 45 young male and female students were asked to perform the test and then repeat it ten minutes later. Correlation between the first and second trials was determined to be 0.73, indicating a high degree of reliability. Intercorrelations were then determined for age, weight, and sex. The figures found ranged from 0.03 to 0.19, indicating that these factors may be disregarded.

Trance subjects consisted of 11 women students, screened from about 100 volunteers by hypnoinduction techniques. We had no objection to using men except that a different range of dynamometer would have been required and women were more easily available.

Hypnosis was induced by one of us, using the hand levitation technic of Erickson, as described by Wolberg.¹⁰ Later, rapid induction methods were substituted as the subjects became more easily handled. The following criteria mentioned by Wolberg and accepted by most students of hypnotic phenomena were used to test the depth of trance:

8. Duvall, E. N.; Houtz, S. J., and Hellebrandt, F. A.: Reliability of a Single Effort Muscle Test, *Arch. Phys. Med.*, 28:213, 1947.

9. Schwab, R. S.: Personal communication to the authors.

10. Wolberg, L. R.: *Medical Hypnosis*, vol. I, *The Principles of Hypnotherapy*, New York, Grune & Stratton, Inc., 1948.

1. Vivid visual, ophthalmic or aural hallucinations, including negative hallucinations (blindness, absence of one arm of the hypnotist).

2. Cutaneous hyperalgesia and analgesia, permitting severely painful stimuli without sign of concern by the subject.

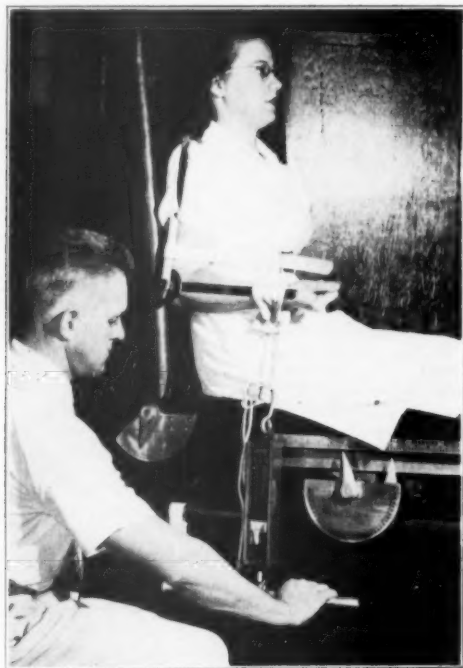


Fig. 1. — Martin arm type dynamometer.



Fig. 2. — Grip type dynamometer test.

3. Complete amnesia for all events during trance.
 4. Regression on command to childhood, with reproduction of some event such as a schoolroom incident, complete with names of children on right and left, the teacher, the row of desks, etc. Ability to give ages of siblings instantly at that time.
 5. Transfer from control of one hypnotist to another.
 6. Strong posthypnotic suggestions (highly compulsive).
 7. Somnambulism—walking on command, sitting, rising, eating imaginary food, etc.
- Not all these tests were employed on all subjects.



Fig. 3. — Endurance test.

TABLE 1. — *Results of Control and Trance Tests.*

Subject	—Arm Dynamometer—		Hand Dynamometer		—Endurance—	
	Normal	Trance	Normal	Trance	Normal	Trance
Ba.	72,84,80	88,90,88	52	65	16.6	32.4
Br.	78,76,78	87,90,94	61	65	53.4	55.8
Wa.	72,72,73	75,74,74	44	35	23.0	24.8
Sh.	65,70,70	72,74,72	48	54	38.6	32.2
Ja.	78,76,70	80,82,82	60	70	59.0	48.6
Ro.	70,73,70	86,88,89	55	65	49.9	31.0
Ge.	78,76,76	85,83,80	82	65	61.9	42.2
Re.	78,78,78	85,83,85	69	67	12.1	26.8
Gu.	67,72,68	92,88,90	40	48	35.4	36.4
Na.	77,74,73	95,98,98	65	72	79.8	45.0
Wal.	70,59,60	85,83,84	62	63	90.5	69.0

Results

Table 2 indicates that there were no significant differences between the trance state and normal controls for the grip dynamometer and endurance

tests. For the arm dynamometer test, however, there was an increase in every single case. The *t* value of 5.25 is considered highly significant in statistical usage.

TABLE 2. — *Analysis of Results of Control Versus Trance Values.*

Test 11 Subjects	M/D*	a/D	cM/D	t	p	Significance
Arm dynamometer	11.76	7.07	2.24	5.26	0.1	Significant
Hand dynamometer	2.82	8.64	2.73	1.03	34.1	Not significant
Endurance test	-7.00	15.21	4.81	1.46	17.0	Not significant

* The difference was taken as trance minus normal.

The magnitude of increased strength under hypnosis averaged 16.8 per cent in the 11 cases, the spread being from 2.6 to 33.3 per cent.

This unexpected difference between the grip and arm dynamometer tests made us analyze the procedure carefully in the latter case to see if some unsuspected factor other than the hypnotic state could account for it. We therefore determined to repeat this test on 22 normal subjects, using the same technic down to the minutest detail except that no hypnosis was used. The

TABLE 3. — *Control Studies Run Five Days Apart; Hypnosis Not Used.*

Test 22 Subjects	M/D	a/D	cM/D	t	p	Significance
Arm dynamometer	1.3	5.086	1.11	1.18	24	Not significant

second trials were made five days after the first, this interval having been used in the original trance tests. Table 3 shows the results of this reliability test. We concluded that we were using a highly reliable test and that the findings indicated in table 2 were solely the result of hypnosis.

Whatever the personal bias of the experimenters may have been, it could never have predicted the pattern of results obtained. If any significant difference were found it would seem that we expected them to be in the endurance test, since ability to maintain cataleptic postures for extended periods of time has long been a popularly supposed endowment of the hypnotized subject.

Comment

Objections to physiologic tests under hypnosis in the past have included (1) lack of consistency in directions to subjects, (2) lack of descriptive analysis of experimental approach, (3) lack of statistical treatment of results and (4) lack of subjective control of subjects, permitting conscious or unconscious cooperation towards a preconceived result.

We have attempted to meet all these objections in this study. We are quite unable to explain why one type of strength test should give reliable increases under hypnosis and another fail. The mechanism of increased performance must result from inhibition under hypnosis of those factors which in normal circumstances act to retard performance. The situation is possibly analogous to that of a swimmer forced to drown or save his life by an effort normally quite beyond him without an increase in motivation. Muscle tension may be increased by only two methods: increase in the frequency of impulses passing down the motor nerves (temporal summation) and increase in the total number of nerve fibers being stimulated at one time (spatial summation). It is quite certain that in normal circumstances these maxima, which are capable of fracturing bones, tendons and muscles, are seldom achieved.

We are not yet prepared to suggest any clinical applications. One of the main objections to clinical use of hypnosis is that it is time consuming and that not all persons are equally susceptible. One might try to increase performance in progressive resistance exercise when a plateau has been reached. One might also try hypnosis in the occasional patient with an alienated quadriceps following a knee injury or in late poliomyelitis with habit alienation of weak muscles. These are highly tentative suggestions.

Before clinical trials are used, further exploration should be carried out with more subjects and additional tests.

Study of the variability in initial trials compared with second and third trials in a single effort test suggests that the first effort should be a warming up exercise and its reading discarded. The next three to five readings can then be averaged.

Summary

1. Eleven subjects were tested before and during deep hypnosis for arm and hand dynamometric strength and for endurance.
2. Independent evaluation established the reliability of the tests used.
3. Significant increases in strength during hypnosis were noted with the arm dynamometer but not with the hand dynamometer. No significant change was observed in the endurance test.
4. In strength testing a practice trial should be first run and not recorded. One reading is significant, but it is better to average three or more.

We are greatly indebted to Prof. Philip DuBois of the Washington University Department of Psychology, for advice in carrying out the experiments and for performing the statistical computations. We are also greatly indebted to the volunteers who acted as subjects of the experiments.

Discussion

Dr. Arthur L. Watkins (Boston): I believe that the authors should be congratulated on their scientific approach to a problem involving psychologic factors whose mechanism is little understood. The variables in the experiments appear to be admirably controlled as far as testing techniques are concerned. We are not given data as to the depth of hypnosis in individual cases, but presumably it was the same in the three different tests used. I wonder whether the control readings were done sometimes before and sometimes after the trance readings, but I should not expect that this would account for the results reported.

There appears to be no doubt that in the case of the elbow flexion test the performance under hypnosis was significantly increased. We are faced, then, with providing an explanation of the failures in the other instances. It is noted that the hypnotic state was used to enhance motivation to perform muscular work. As the hypnotic state is characteristically one of increased suggestibility, this seems logical. One of the limiting factors in muscular work, particularly maximum efforts of short duration, is pain or discomfort or apprehension. If we examine the three tests from that point of view, perhaps some insight can be gained. In the first place,

the elbow flexion test produces distinctly less discomfort than the other two, I believe, particularly when care is taken, as in this case, to stabilize the subject properly.

I have plotted the results of table 1 and noted that in the hanging test the spread of scores was from 12 to 90 seconds, with a mean of 47 during the control readings, but during the trance the spread was only 24 to 69, a drop from 78 to 45 seconds. Similarly with the grip test the spread was reduced most notably as shown by the scattergram.

The results in the elbow flexion test show no such spread in either control or trance periods. If one assumes that the variation in results in the other tests is related to variations in tolerance to discomfort, the trance state would seem actually to have an effect, namely, that of leveling out these differences in pain tolerance, which perhaps obscured other possible effects.

One would be interested in knowing what the results would show if the suggestion were made that all discomfort and apprehension would be absent in addition to the suggestion that the subject is strong.

I think that it would also be interesting to know the effect of posthypnotic sugges-

tion on such strength tests and wonder if some observations were made.

I again should like to compliment the authors on their carefully planned and executed study, and I hope that they will be encouraged to pursue further the important problem of psychologic motivation and its effect on physiologic performance.

Dr. Mead (closing): Dr. Watkins has suggested that the pain factor may have accounted for the difference between the various tests employed. Perhaps we did not sufficiently exclude such a factor. We plan to carry out further experiments to test its significance.

It was also asked whether we had carried out posthypnotic suggestion on performance tests. This was not included in the experiments. It will be interesting to see whether any new facts come out with posthypnotic suggestion.

In closing, it might be worthwhile to point out that there is a division of belief concerning the basic nature of hypnosis. One authority, Wells, insists that hypnosis is not merely a heightened degree of suggestibility, but is qualitatively completely different from the phenomena of ordinary life. We are not prepared to enter into this controversy at the present time.

THE TONIC NECK REFLEX IN THE HEMIPLEGIC

An Objective Study of Its Therapeutic Implication *

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Sherrington,¹ on the basis of experiments on decerebrate animals, concluded that afferent stimuli influence postural reactions. Magnus and de Kleijn² demonstrated the effect which afferent impulses arising in the neck muscles have on the limb musculature of the decerebrate preparation. They found that on rotation of the animal's head spontaneous extension of the limbs occurred on the side toward which the snout was pointed and spontaneous flexion of the limbs resulted on the opposite (occiput) side.

Magnus and de Kleijn,³ Walshe,⁴ Davis,⁵ Marinesco and Radovici,⁶ and others have described the presence of the tonic neck reflexes in man. These reflexes are considered to be postural reactions. They are usually elicited as changes in tone. Involuntary or associated movements, such as elevation of the involved arm while yawning or on movements of the normal extremities, may be seen in some cases. The direction—i.e. abduction or adduction—in which

* Read at the Twenty-Seventh Annual Session of the American Congress of Physical Medicine, Cincinnati, Sept. 7, 1949.

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* Aided by a grant from the National Foundation for Infantile Paralysis, Inc., while a Fellow in Physical Medicine and Rehabilitation at the New York University-Bellevue Medical Center.

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2. Magnus, R.: Körperstellung, Berlin, Julius Springer, 1924.

3. Magnus, R., and de Kleijn, A.: Weitere Beobachtungen, über Hals und Labyrinthreflexe auf die Gliedermuskeln des Menschen, *Arch. f. d. Physiol.* 160:129, 1915.

4. Walshe, F. M. R.: The Decerebrate Rigidity of Sherrington in Man, *Arch. Neurol. & Psychiat.* 10:1, 1922.

5. Davis, L. E.: Decerebrate Rigidity in Man, *Arch. Neurol. & Psychiat.* 13:569, 1925.

6. Marinesco, R. G., and Radovici, A.: Contributions à l'étude des réflexes profonds du cou et des réflexes labyrinthiques, *Rev. neurol.* 3:13, 1924.

the hemiplegic arm will move during voluntary or involuntary elevation is influenced by the position of the head. Spontaneous extension of the elbow of the paretic arm on turning the face toward the affected side has not been observed in patients with hemiplegia. In our own experience, we have seen extension of the elbow only when a voluntary component is present.

In this paper, when we refer to extension of the elbow, we mean a pattern of movement which includes extension of the elbow and not isolated triceps action. This distinction is necessary because the reflex affects groups of muscles and not individual muscles. Kabat⁷ and Fay⁸ have expressed the belief that reflex patterns can be utilized as an aid to establish patterns of motion in spastic neurologic conditions such as spastic hemiplegia. Yamshon⁹ noted in patients with spastic hemiplegia an increase both in strength and in degree of extension of the elbow when the tonic neck reflex is used to reinforce voluntary motion. A review of the literature failed to reveal any attempt to measure the strength effects of the tonic neck reflexes on extension of the elbow in man. In order to measure the influence of the tonic neck reflexes on extension of the elbow, the following apparatus and test was devised.

Experimental Study

Apparatus.—The apparatus consisted of a track, a carriage and a canvas bucket (fig. 1). The carriage was devised to carry the hand and forearm. A bar was placed on the anterior end of the carriage to dorsiflex the wrist and to prevent the hand from sliding forward. The fingers and wrist were fixed by means of webbed straps. The carriage was mounted on ballbearings so that it would roll with a minimum of friction. A track was constructed to limit movement of the carriage to forward and backward. It prevented lateral movement. Pulleys were placed at the rear end of the track, and ropes extending from the posterior end of the carriage passed over the pulleys to be attached to a canvas bucket.

Procedure.—The patient was seated in a straight back chair and positioned as follows: The paretic arm is abducted as close to 90 degrees as possible. The hand was fixed by the webbed straps to the carriage. The initial position of the elbow was 90 degrees flexion. To minimize substitution, a harness was used to stabilize the patient against the back of the chair. The patient was asked to push the carriage forward. This motion was performed while the head was in each of three positions and in the following sequence: (1) facing forward, (2) facing the normal side and (3) facing the affected (hemiplegic) side. Before proceeding from one head position to another, the maximum elbow extension and strength were determined for that head position. The strength was measured by weights placed in the canvas bucket, the range by goniometry.

Types of patients.—A total of 27 patients with hemiplegia as a result of cerebral vascular accident were tested. Twenty-two patients had marked spasticity, 2 had hemiparesis and 3 were athetoid. There were 17 males and 10 females. The right side was involved in 13 cases and the left side in 14 cases. Patients who were unable to extend their involved elbows to any degree, in any circumstances, were eliminated from this series. Otherwise, the cases were unselected. In tables 1, 2 and 3 the patients are grouped for convenience according to their disability and not in the sequence tested.

Results and Comment

The results are presented in tables 1, 2 and 3. It can be noted there are two columns for each head position. The first column is the maximum number of degrees of elbow extension without weight. The only resistance is that of the carriage and its attached canvas bucket. In the second column are tabulated the maximum amount of weight which has been added in $\frac{1}{4}$ pound increments and has been lifted to the same degree as in the first column or to a greater degree. For example, in table 1 it is seen that patient 1 extends the elbow 150 degrees without weight while the face is turned toward the involved side. She can repeat this performance with $\frac{1}{2}$ pound, but is unable to do so when an additional $\frac{1}{4}$

7. Kabat, H.: Studies on Neuromuscular Dysfunction: XI. New Principles of Neuromuscular Reeducation, Permanente Found. M. Bull. 5:11, 1947.

8. Fay, T.: The Neurologic Aspects of Therapy in Cerebral Palsy, Arch. Phys. Med. 29:324, 1948.

9. Yamshon, L. J.: The Arm in Hemiplegia and the Use of Neck, Reflex Action in Rehabilitation, to be published.

pound is added. In this case $\frac{3}{4}$ (0.75) is considered to be the drop-off point and is not charted. Since the initial position of the elbow is 90 degree flexion, only degrees greater than 90 indicate motion.

In 22 cases of hemiplegia, the average maximum degree of elbow extension is 124.1 degrees when the face was turned toward the normal side and 155.5



Fig. 1. — Head facing hemiplegic side. Increased elbow extension on voluntary effort. See text.

degrees when the face was turned toward the involved side. There was an average increase of 31.4 degrees. The average maximum amount of weight lifted was 0.21 pound when the face was turned toward the normal side and 0.89 pound when the head was turned toward the hemiplegic side. The average increase was 0.68 pound. This represents an average increase of 25 per cent in degrees and 324 per cent in pounds. These figures are statistically significant. The critical ratio is 4.1 for degrees and 3.1 for pounds. An average increase of 17.6 degrees and 0.17 pound was obtained when facing forward as compared with facing the normal side. When the head was turned toward the hemiplegic side, the average increase over facing forward was 13.8 degrees and 0.51 pound, or 9 per cent in degrees and 134 per cent in pounds (table 1).

In 2 cases of hemiparesis (table 2) and 3 cases of athetosis (table 3) the same trend can be noted. However, since the number of cases in those categories is so small, we believe that a statistical conclusion can not be drawn.

The results obtained in the series of cases of spastic hemiplegia are significant

TABLE 1.—*Spastic Hemiplegia.*

Case	Hemiplegic Side	Age	Sex	Face Toward Normal Side		Face Straight		Face Toward Involved Side		No.°	Wt.	No.°	Wt.	No.°	Wt.
				No.°/O Wt.	Max.°/Max. Wt.	No.°/O Wt.	Max.°/Max. Wt.	No.°/O Wt.	Max.°/Max. Wt.						
1	R	63	F	130/0	130/0	145/0	145/0	150/0	150/0.5	20	0.5	5	0.5	15	0
2	R	65	F	120/0	120/0	130/0	135/.25	150/0	170/1.0	50	1.0	35	0.75	15	0.25
3	R	45	F	90/0	90/0	125/0	125/0	145/0	170/.25	80	0.25	45	0.25	35	0
4	R	49	F	170/0	170/0	170/0	170/1.25	170/0	170/3.5	0	3.5	0	2.25	0	1.25
5	R	50	M	110/0	110/0	130/0	135/.25	130/0	140/0.5	30	0.5	5	0.25	25	0.25
6	R	61	M	95/0	95/0	100/0	100/0	145/0	150/0.5	55	0.5	50	0.5	5	0
7	R	45	M	90/0	90/0	90/0	90/0	145/0	150/0	55	0	55	0	0	0
8	R	32	M	90/0	90/0	125/0	125/0	170/0	170/1.0	80	1.0	45	1.0	35	0
9	R	47	M	155/0	155/0	160/0	165/1.0	165/0	170/.75	15	0	5	-0.25	10	0.25
10	R	66	M	95/0	95/0	120/0	130/.25	150/0	150/0.5	55	0.5	20	0.25	35	0.25
11	L	65	F	145/0	145/0.5	140/0	145/1.0	150/0	150/2.25	5	1.75	5	1.25	0	0.5
12	L	57	F	140/0	140/0.25	140/0	145/0.5	145/0	145/0.75	5	0.5	0	0.25	0	0.25
13	L	62	F	120/0	120/0	145/0	170/0	170/0	170/0	50	0	25	0	16	0
14	L	61	F	120/0	130/0	135/0	145/0.75	155/0	155/2.5	25	2.0	10	1.5	10	0.25
15	L	61	M	120/0	120/0.25	130/0	130/0.5	150/0	150/0	30	-0.25	20	-0.5	10	0.25
16	L	75	M	150/0	150/1.25	140/0	160/1.25	165/0	165/2.5	15	1.25	5	1.25	10	0
17	L	50	M	100/0	100/0	125/0	125/0	135/0	135/0	35	0	10	0	25	0
18	L	61	M	130/0	130/0.5	140/0	140/0.75	140/0	140/0.75	10	0.25	0	0	10	0.25
19	L	59	M	90/0	90/0	170/0	170/0	160/0	170/0.5	80	0.5	0	0.5	80	0
20	L	65	M	150/0	150/0.25	145/0	145/0	145/0	150/0.5	0	0.25	5	0.5	5	-0.25
21	L	38	M	160/0	160/0.5	170/0	170/0.5	170/0	170/0.75	10	0.25	0	0.25	10	0
22	L	63	M	120/0	120/0	140/0	150/0.25	145/0	145/0.75	25	0.25	-5	0.25	30	0.25
AVERAGES				121.4/0	124.1/0.21	137/0	141.7/0.38	152.3/0	155.5/0.89	31.4	0.68	13.8	0.51	17.6	0.17

if one considers the degree of elbow extension and the percentage increase in weight when the face is turned toward the involved side. The actual amount of force in pounds will vary according to the method of testing used. For example, a person who can lift 3 pounds by this method can push 70 pounds along a smooth waxed surface. The markedly decreased ability by this method is due to friction over the pulleys and to the fact that the weight is lifted against

TABLE 2.—*Hemiparesis.*

Case	Hemiplegic Side	Age	Sex	Face Toward Normal Side		Face Straight		Face Toward Involved Side	
				No.°/O Wt.	Max.°/Max. Wt.	No.°/O Wt.	Max.°/Max. Wt.	No.°/O Wt.	Max.°/Max. Wt.
1	R	57	M	170/0	170/2.5	170/0	170/2.75	170/0	170/3.75
2	L	64	M	160/0	160/4.75	160/0	160/7.25	160/0	160/7.75

gravity. Since the objective is to determine whether or not there is an increase in strength when the tonic neck reflex is used to reinforce voluntary motion, the amount of weight is important only as a factor in relation to the head positions. In any given case all other factors as position, apparatus and myotatic reflexes are constant. The only variables are the strength of the patient and fatigue. The strength in each case is measured in relation to the head position and not in comparison to strength in another patient. Fatigue is a difficult factor to measure. It undoubtedly influenced the results. In this series turning the head toward the hemiplegic side was measured last. Any fatigue which might be present would be reflected in the ability to raise the weight, and its influence

would work against the premise that turning the head toward the hemiplegic side reinforces the strength of voluntary motion. In spite of the fatigue factor, the utilization of the tonic neck reflex increases the degree and strength of elbow extension when the face is turned toward the hemiplegic side.

TABLE 3. — *Athetoid Patients.*

Case	Hemi- plegic Side	Age	Sex	Face Toward Normal Side		Face Straight		Face Toward Involved Side	
				No. °/O Wt.	Max. °/Max. Wt.	No. °/O Wt.	Max. °/Max. Wt.	No. °/O Wt.	Max. °/Max. Wt.
1	R	57	F	170/0	170/10.0	170/0	170/14.0	170/0	170/15.0
2	R	62	M	170/0	170/7.0	170/0	170/9.5	170/0	170/12.5
3	L	54	F	170/0	170/7.0	170/0	170/10.0	170/0	170/15.0

In some cases on the addition of weight there was an increase in the degree of elbow extension during a given head position. This can be interpreted as (1) failure of maximal effort on trial without weight, (2) inherent error in goniometric measurement and (3) increased stimulation of the myotatic reflex mechanism.

While determining the degree of elbow extension one must avoid substitution by the body. There is a tendency to push forward with the body and carry with it the fixed arm. Hyperextension at the shoulder is prevented by the tonic adductors and internal rotators. Consequently, when the patient relaxes and sits back after a strong effort, the arm will remain at its extended position and give the impression of increased extension at the elbow. This error can be minimized by placing the patient in a harness which holds the body to the back of the chair.

TABLE 4. — *Effect of Treatment.*
(Head toward hemiplegic side)

Case	Table	Date	Max. °/Max. Wt.	Date	Max. °/Max. Wt.	Date	Max. °/Max. Wt.
16	1	6/15/49	160/2.5	6/27/49	160/8.5	7/7/49	165/9
13	1	6/15/49	145/0.75	6/30/49	155/1.25	7/7/49	155/1.5
21	1	6/15/49	170/0.75	6/27/49	170/1.0	7/7/49	170/1.75
1	2	6/16/49	170/3.75	6/29/49	170/7.5	7/7/49	170/8.25
R.W.		6/15/49	90/0	7/7/49	150/0.25		

The arm is abducted as close to 90 degrees as possible. Yamshon⁹ noted that extension of the elbow could be best obtained when the arm was elevated and supported at 90 degrees. This position is most favorable for the action of the deltoid (Yamshon and Bierman,¹⁰ Inman, Saunders and Abbott¹¹ and Foerster¹²), which is not only paretic by the nature of the condition but is frequently atrophied owing to disuse. The deltoid synergistically acts on the shoulder while the triceps extend the elbow as the arm moves forward. It must be remembered that one is dealing with a pattern of movement and not with the action of the triceps per se. The synergistic action to produce this pattern of motion by the muscles of the upper extremity plays an important role in this test.

In order to test the efficacy of exercise on the paretic arm, several patients under treatment were rechecked periodically. Only elbow extension with face toward the involved side was determined. In table 4 can be seen the improvement in strength as a result of exercise. Arm exercise consisted for the most part of sanding and sawing in the occupational therapy department. While we

¹⁰ Yamshon, L. J., and Bierman, W.: Kinesiologic Electromyography: III. The Deltoid, Arch. Phys. Med. 30:285, 1919.

¹¹ Inman, V. T.; Saunders, J. B. de C., and Abbot, L. C.: Observations on the Function of the Shoulder Joint, J. Bone & Surg. 26:1, 1944.

¹² Foerster, O.; in Bunke, O., and Foerster, O.: Handbuch der Neurologie, vol. 3, Berlin, Julius Springer, 1927.

did not utilize the weight-lifting capacity to determine the amount of resistance, this can be done and the apparatus can be used for resistive exercises. From this point of view, it is readily seen that one can give greater resistance by utilizing the tonic neck reflexes, i.e. turning the head toward the hemiplegic side. It is possible that the apparatus may be used in attempting to redevelop a pattern of motion.

Summary and Conclusions

The influence of the tonic neck reflexes was tested on 22 patients with hemiplegia due to cerebral vascular accident.

It was demonstrated that the spastic hemiplegic patient can extend his elbow to a greater degree and with greater strength when the face is turned toward the involved side than when face is forward or turned toward the normal side. A similar observation was noted in 2 cases of hemiparesis and in 3 cases of athetosis.

A useful method of muscle testing and therapeutic evaluation is provided.

Atrophy of disuse in hemiplegia can be treated by functional exercise.

It may be possible to utilize the tonic neck reflex to reestablish a pattern of motion.

We wish to express our appreciation to Miss Nowicki and Miss M. Miller of the occupational therapy department for their help in constructing the apparatus, and to Miss A. Aloisi for her aid in preparing the manuscript.

PREVENTION OF VENOUS THROMBOSIS AND EMBOLISM BY ELECTRICAL STIMULATION OF CALF MUSCLES *

Further Study of Clinical Application and Results

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Recently we reported our experience with the use of electrical stimulation of the calf muscles to prevent venous thrombosis and embolism¹; at that time we had been using the method for eighteen months. We have now continued to use the method for an additional year, with satisfaction.

Because of the dramatic events, even including death, that may accompany pulmonary embolism, it is that sequela to which attention has often been focused by investigators of venous thrombosis. We feel that the living victims of thrombosis without embolism are also of great importance, espe-

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1. Tichy, V. L.: Prevention of Venous Thrombosis and Pulmonary Embolism by Electrical Stimulation of Leg Muscles, *Surgery*, 26:109 (July) 1949.

cially those who carry the burden of swollen, aching and often ulcerated legs ever after. Any form of therapy which has for its goal the prevention of death by embolism, without regard for the greater proportion of persons who survive with crippled limbs, is thus incomplete.

Our views with respect to the origin of postoperative thrombosis in most cases seem to be confirmed by the clinical results of our treatment. We have felt that damage to the soft tissues, including the intima of small veins, occurs from the trauma of prolonged pressure on relaxed muscle and fascia of the legs and feet during and shortly after operation. Slowing of the circulation results from direct pressure, deep anesthesia, shock, narcosis and sedation and is the second factor in the formation of thrombi. Continuation of slowed circulation from these and other causes, such as pressure against larger venous channels in the lower extremities, obesity, abdominal distention, faulty position and abdominal tumors or inflamed masses, results in growth of the thrombi into larger channels. We cannot stress too much this deleterious effect of pressure on the calves and slow circulation of central or peripheral cause at the time the patient is anesthetized or cannot move about owing to extreme illness or sedatives.

That complete success in prevention of thrombosis is most difficult may be realized by considering the number of so-called spontaneous thromboses among persons who are up and about and seemingly well, and the factor of increased clotting tendency in persons in postoperative state or with pneumonia and other illnesses. The great majority of our patients were treated for a relatively short portion of the postoperative course, and our results may help to serve as a comparison in investigations of the problem along different lines.

Use of anticoagulants in treatment of venous thrombosis is valuable not only in saving life but, when used early, in decreasing the extent of the process and thus preserving the venous system nearer to normal. Prophylactic use, however, has been generally impractical because of complications of hemorrhage. Inability to use anticoagulants as a preventative measure leads to the important drawback that some irreversible damage is already present before treatment.

Ambulation, likewise, is impractical in the immediate treatment of patients who have undergone a major surgical procedure or have severe illness. The mere getting out of bed and sitting in a chair may be more harmful than effective in the case of a seriously ill person. Early exercise may be helpful in preventing development of the incipient process only when that process is very slight and asymptomatic.

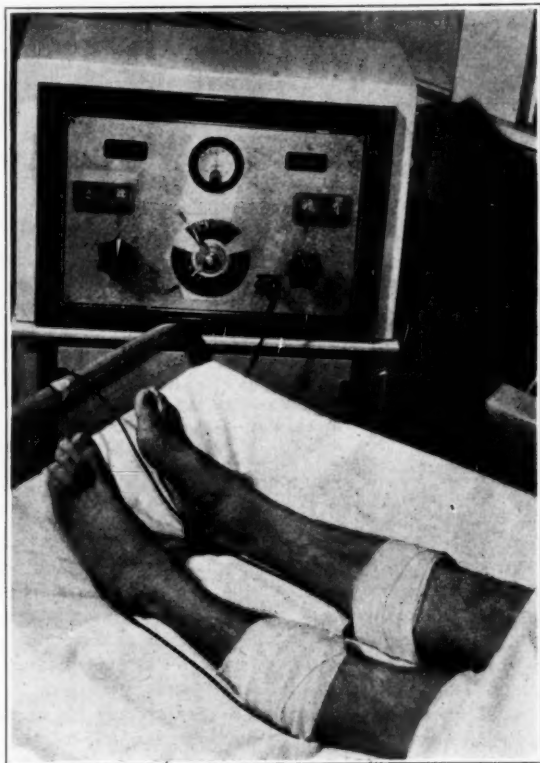
Electrical stimulation of the calf muscles can be used on almost all types of surgical or medical patients, without disturbing them sufficiently to interfere with routine care. The disturbance incident to the application of cuffs is actually beneficial manipulation in that the position of and pressure on an extremity are changed, often while the extremity is still paralyzed from the anesthetic.

We began treating patients in January, 1947. Muscle activity is known to increase blood flow, but we felt that some experimental evidence should be obtained before doing too much tedious clinical work. Thus some experiments were conducted on femoral blood flow in dogs during stimulation of muscles of the hindlegs,² and studies were made on circulation time from leg to brain on patients being treated. Preliminary clinical and favorable

2. Tichy, V. L., and Shaw, B. W.: Augmentation of Femoral Venous Flow in the Dog by Electrical Stimulation of Muscles, *Proc. Soc. Exper. Biol. Med.* 69:368 (Nov.) 1948.

experimental results were presented at the November, 1947 meeting of the Experimental Medicine Section of the Cleveland Academy of Medicine. The first published clinical report included an analysis of results on 792 patients treated, and now we are able to present another series of 639 patients with even better results.

That the problem has attracted the attention of others is shown by the report of Apperly and Cary,³ who reported experiments on 4 subjects, show-



Method of applying stimulation.

ing decrease of arm to tongue circulation time on electrical stimulation of the muscles of the lower extremities during "gravity shock" and that of McCarthy, McGuire, Johnson and Gatewood,⁴ who stated that they are using a mechanical leg compressor on surgical patients. As far as we know, these groups have not as yet cited any records of results on postoperative patients.

Technic

The treatment is instituted as soon as possible after the patient has been returned from the operating room. A pad electrode, approximately 4 by 5 inches, thoroughly moistened with dilute saline solution, and covered with two or three layers of gauze similarly moistened,

³ Apperly, L., and Cary, M. K.: The Control of Circulatory Stasis by the Electrical Stimulation of Large Muscle Groups, *Am. J. M. Sc.* **216**:403 (Oct.) 1948.

⁴ McCarthy, H. H.; McGuire, L. D.; Johnson, A. C., and Gatewood, J. W.: A New Method of Preventing the Fatal Embolus, *Surgery* **25**:891 (June) 1949.

is applied to the calf of each leg and is held in place by an elastic bandage in such a way that not too much pressure is exerted against the skin and yet the electrode does not move on the leg. By means of a cord and clips, each electrode is then connected to the two outlets of a sinusoidal machine (shown in the figure). The current is gradually turned on until a gentle contraction is noted in the calf. The amount of current will vary with the individual patients; usually 4 to 5 milliamperes will produce a satisfactory contraction. As the resistance of the tissues is lowered after a few minutes of treatment, the current may have to be reduced correspondingly. It is, therefore, well for the technician to stay with the patient for a few minutes and observe the contractions, so that the strength of current may be reduced as indicated. The rate of contractions is approximately 22 per minute. The stimulation is continued for thirty minutes, after which the current is shut off for thirty minutes. This process is repeated, thirty minutes on and thirty off, for twenty-four hours or until the patient is able actively to move his extremities.

Where sufficient technical help is available, any standard sinusoidal machine can be used for the purpose of postoperative stimulation. To obviate the necessity of half-hour manipulation, an automatic sinusoidal machine has been developed which can be set to start and stop at predetermined intervals within a sixty minute period. To prevent a sudden rapid rise of current, two thermistors are inserted into the circuit, thus allowing for a gradual increase of current at the beginning of each treatment cycle. Whichever type of apparatus is used, it is important to keep the electrodes moistened with saline solution. If this is not done, a pricking sensation will be produced by the current. If the current is properly regulated and the electrodes kept moist, most patients will stand the treatment without any difficulty. Occasionally a patient is hypersensitive even to a mild current. If a reaction occurs, the treatment is discontinued.

Since the purpose of the treatment is to stimulate muscle, it is necessary to check the technic frequently to be sure that the electrode has not moved away from the calf on to a part of the leg which is not amenable to stimulation. Such inspection has occasionally revealed a displacement of the electrodes to the front of the leg and even to the ankle.

The technician should also be cautioned to stop the stimulation at the prescribed intervals. Failure to do so may result in unnecessary discomfort and may vitiate the treatment through the production of muscle fatigue. With the automatic apparatus this danger is eliminated.

Results

As a rule, the only patients who objected to the treatment were those who had recovered so well and quickly that they were able to move their extremities voluntarily. Most of the others accepted it without comment or even enjoyed the mild exercise, which simulated walking to some degree. On some occasions, the technicians did not regulate the current properly and caused discomfort, even leading to muscle soreness. This point is of importance, as avoidance of overstimulation is most necessary in the early phase, when the patient is still under the influence of anesthesia or narcosis. In this series, a small portion of the patients were treated for more than one day. This included such patients as had undergone splenectomy, in which clotting is always a danger, for whom treatment was continued for two or three days, and even 1 patient who recovered from mesenteric thrombosis; in this case it was continued for over two weeks. Not all patients treated were included in the figures in the table. Approximately 100 patients who had minor procedures, such as hemorrhoidectomies, quite unlikely to result in leg vein thrombosis, were not included.

Thrombosis occurred in 1 patient, aged 32, who had a left inguinal herniorrhaphy. It involved the calf and apparently the femoral veins but was controlled without incident with anticoagulant therapy. In 1 other patient, a 40 year old woman who had a transthoracic vagotomy, there was slight soreness and tenderness of the lower part of the calf and anticoagulants were used. There was no swelling and no positive Homans sign, and the symptoms subsided in a very short time. This was listed as a doubtful case by the attending surgeons but has been included in the table. Incidentally, this patient had multiple complaints.

Occasionally, because apparatus is not available, some patients are not treated on the general surgical service. During the year covered by this report, 1 patient with herniorrhaphy not treated, had thrombosis of the leg

Results of Stimulation.

Type of Operation	Total	No. of Patients With Thrombosis
Pelvic laparotomies, female.....	10	....
Pilonidal sinus, fistula, perirectal abscess.....	67	....
Hernia, including bilateral, femoral and many with Cooper ligament type of repair (under 40, 119; over 40, 94).....	213	1
Ventral hernia	7	....
Miscellaneous extensive procedures.....	57	....
Appendectomies, chiefly emergency.....	82	....
Cholecystectomies, duct explorations.....	50	....
Major gastric, including resection, gastroenterostomy plus vagotomy.....	56	....
Miscellaneous abdominal, including resection of tumor, exploration with colostomy, abscess, splenectomy.....	20	....
Intestinal resections, including abdominoperineal.....	40	....
Vagotomies	8	1
Sympathectomy, dorsal or lumbar.....	16	....
Thigh amputations	13	....
Total	639	2

With thrombosis, 0.3 per cent.
Embolism, 0.0 per cent.

with pulmonary embolism, and another had venous thrombosis of the right leg following gastric resection. Both made good recovery with anticoagulant treatment. On one of the specialty services where electrical stimulation is not used and surgical procedures often involve the perineum or pelvis, there were 4 patients with thrombosis of the leg veins; 1 of them recovered from a pulmonary embolus.

Comment

In contrast to the 2 cases of thrombosis which developed after treatment (and 1 of these was doubtful), we feel that we might have expected at least 20 or more, despite the good general preoperative and postoperative care given, had electrical stimulation not been used. Furthermore, we might have expected at least some of those patients to have pulmonary embolism. Many of the patients were in the older age groups, 44 per cent of those with inguinal hernia being over 40 years of age. Many, because of age and type of disease, are generally considered by interested surgeons as belonging in the class very liable to thrombosis.

We hope to be able to continue these treatments with proper control series in the future, so that more significance may be given the figures obtained.

Results thus far continue to support the belief that the time in the operating room and the first few hours or days immediately after operation constitutes the critical period during which thrombosis occurs in the legs and incipient emboli develop.



RATIONALE AND USE OF MUSCLE RELAXANTS IN NEUROMUSCULAR DISORDERS *

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The goal of therapy in neuromuscular disorders lies in increased efficiency of performance and relief of discomfort. Except specific surgery and drugs (which are distressingly rare), traditional physical therapy has the most to offer. Strengthening and coordination exercises, the improvement of habit patterns and the employment of prostheses often contribute a great deal. Frequently, however, there are present neuromuscular abnormalities which either make positive therapy difficult or are actually potentiated by active motion. In such cases an attempt to ameliorate the abnormal bombardment is critically important.

The neuromuscular disorders with which we are concerned are roughly of two types: involuntary movement and abnormal reflex phenomena. The first group, which includes the various dyskinesias, is secondary to bombardment of the peripheral motor apparatus by impulses arising centrally. The latter group consists in spasticity or hyperactive stretch response, mass reflex and true muscle spasm. These states generally represent the release and facilitation or potentiation of reflex patterns and do not ordinarily depend on central bombardment but, rather, on its lack. Some states (such as rigidity) combine central and peripheral mechanisms. Treatment of the first group of disorders is difficult and inefficient. I wish there were time to dwell on their neurophysiologic and biochemical natures, especially in the light of recent observations. However, they lie somewhat outside the limit of the present discussion.

It is in the treatment of true muscle spasm and spasticity that the muscle relaxants have a rational application. The drugs with the longest clinical history, the quaternary ammonium salts, as exemplified by curare, are of occasional usefulness. Their chief site of action is at the myoneural junction, but the mode of action is still not completely understood. An attractive hypothesis is that curare blocks the activation of the end plate potential by acetylcholine and thus prevents excitation of the muscle. Since differing concentrations of curare can alter the size of the end plate potential, a partial block can be obtained. Physically, this phenomenon resembles the Wedensky inhibition. Since various stages of block to neuromuscular transmission can be obtained, it is possible to achieve relaxation without complete paralysis. Under certain conditions, an efficient block can be created with increased fatigability or decreased work tolerance as the only evidence of curare intoxication.

The therapeutic possibilities of such a partial block are obvious. Muscle spasm is a reflex defense phenomenon, a prolonged contraction not amenable to voluntary control, characterized by resistance to stretch and by diffuse, severe, poorly localized pain. How does this state come about? There are

* Aided by a grant from the National Foundation for Infantile Paralysis, Inc.
* Read at the Twenty-Seventh Session of the American Congress of Physical Medicine, Cincinnati, Sept. 10, 1949.

many possible mechanisms which may act as the initial stimulus. First, there may be actual irritation of the sensory nerve endings in the muscle mass itself. This may be due to mechanical trauma or inflammatory exudate. Second, muscle spasm may represent protective splinting of a neighboring joint which is the seat of disease. Lastly, the abnormal state of contraction may be secondary to changes in other parts of the neural arc, such as in the posterior columns, posterior root or sensory ganglion. Pathologic changes in these structures may lead to hyperesthesia, pain and diffuse tenderness in the muscle, which reacts by an attempt at shortening and immobilization.

All this may be worthy of further clarification. Normally, muscle stretch elicits afferent impulses arising in the muscular spindles. These impulses are conducted back to the cord, and a reflex contraction is then initiated by way of the motor side of the arc. This is the basic stretch reflex of Sherrington. When there is pathologic change somewhere in the system, there may be a potentiation of this cycle. The threshold of the arc is lowered, and the response becomes much more active than in normal circumstances. Thus we have the mechanism for a self-perpetuating circuit, the vicious cycle of pain and splinting or spasm. Attempted stretch elicits pain and further splinting, then more pain, and so on.

It must be emphasized that in attempting to influence these phenomena, we are attacking not the primary disease entity but merely its secondary manifestations. Nevertheless, such changes may leave the patient crippled permanently, even though his primary disease be in complete remission.

How do we propose to handle such a situation? It is known that any agent which acts by relieving pain or avoiding movement is useful in symptomatic relief. Any form of therapy which invades or breaks up the vicious cycle of pain and spasm may dramatically alter the clinical picture. Promotion of absolute rest has many dangers and needs no discussion here. Heat, analgesics, local anesthetic blocks, etc., are time-tried and respected forms of treatment. Unfortunately, none are specific or reliable. In an attempt to attack the problem more basically, I have turned to the muscle relaxants and have attempted to utilize their ability to create a partial neuromuscular block. In the treatment of the acute low back condition and the acute arthritides, muscle relaxant therapy seems logical and purposeful. They appear to improve the response to physical therapy, relieve pain, increase possible range of motion and thus increase blood supply.

As one might suspect, drugs which work at the myoneural junction are not nearly so efficient in spasticity. Spasticity, or hyperactive stretch reflex, is not as simple an entity as muscle spasm, and only partial success with relaxant drugs is obtained at best. Curiously enough, when some voluntary motor power is present, curare may often reduce exaggerated stretch response. On the other hand, it is seldom if ever useful in complete paralysis with spasticity. The former depends on elimination of suppressor activity mediated by extrapyramidal tracts and continuing unopposed activity of facilitating central neural systems (as suggested by Magoun). Spasticity in the completely transected cord is no longer affected by either central suppressor or facilitation systems but depends on local activity in the isolated segments and might be expected to differ in some respects from the other types. Feldberg has demonstrated the cholinergic nature of certain tracts. It may well be that the differing response of the completely transected spastic cord depends on a fundamental variance in neurohumoral mechanism.

In the treatment of hyperactive stretch response, the drugs which are more active centrally are more efficient. This group is best represented by

myanesin (or Tolserol), a substituted ether of glycerol of synthetic origin. Myanesin in fairly low concentrations works at the brain stem level and can efficiently ameliorate abnormal neuromuscular bombardment by either increasing suppression or reducing facilitation in the centers located in the bulbo-reticular substance. In higher concentration it can depress lower segmental levels, involving more primitive cord reflex arcs. It is not purely a motor depressant and has a procaine-like temporary effect. This mixed pharmacologic effect disappoints one who hopes to use it as an experimental tool. Clinically, however, the usefulness of the drug is increased by its analgesic potency.

The chief indication for this type of specific muscle relaxant is in the treatment of acute muscle spasm. It is equally effective in spasticity, but the evanescent action reduces its usefulness. I may add here that although there are a great many reports of its efficiency by mouth, I am of the opinion that its therapeutic value can only be safely predicted when given by the intravenous route.

It is in the common wear and tear syndromes of everyday practice that myanesin should prove of most value. Skeletal muscle spasm is a factor of importance in the acute low back and frozen shoulder syndromes, the arthritides and countless other acute disorders of the musculoskeletal system. A drug which will break up the well known vicious cycle of pain and muscle spasm is most welcome to the medical armamentarium. Long term therapy is usually not as necessary as abrupt relief of the acute attack, and therefore the limitations of route of administration are not so important.

In the acute low back and cervical spine syndromes, the specific relaxant and analgesic effect of myanesin has a proper place. As an aid or substitute for traction, it is most efficient. In the treatment of the acute low back and disk syndromes, it seems to be of value in reducing acute muscle splinting and affording abrupt relief of pain. If the pain is in part due to the muscular changes, relief is dramatic and may be of long duration. If the pain is secondary to severe nerve root compression, the relief is followed by an equally rapid return of pain. This response has proved of real diagnostic aid in evaluating conservative treatment of herniation of the nucleus pulposus. When pain returns shortly, or is inadequately relieved, we have never seen an adequate response to conservative treatment. In such cases, the root is probably compressed against the incarcerated lesion and cannot be freed by muscular relaxation or skeletal traction. The saving in time and money to the patient is considerable if a long and disappointing trial on bed rest can thus be avoided.

The treatment of vertebral fractures and dislocation consists in an attempt to exert traction in the proper axis so that, after achieving muscle fatigue, the structures will fall back into proper alignment. At times, the reactive muscle spasm and accompanying pain are most severe and make successful reduction difficult and slow to obtain. Myanesin has a real indication as an adjunct to such therapy and can both cut down the pain and hasten the reduction. For purposes of brevity, I shall not amplify this therapeutic approach any further, but its applications are obvious.

We have used myanesin in many other ways, some therapeutically remote, some of chiefly diagnostic interest. For example, for the evaluation of the role of muscle spasm in the arthritides of the spine, it has been a most useful tool. Temporary relief of pain is dramatic, as is restoration of mobility. Whether long term ankylotic changes can be prevented by such treatment, we must wait to see.

I should like to mention several other roles in which the drug has been of real value. One is in the management of the motor manifestations of tetanus. These episodes are difficult to handle, and traditional therapeutics is notably inefficient. Curare is useful but most difficult to handle, and, I suspect, at times a party to the fatal outcome as often as a therapeutic triumph. In addition, it has a spinal cord excitant although a peripheral depressant action. In a disease characterized by excessive facilitation or excitation of spinal cord activity, it leaves room for improvement. Myanesin, as a spinal cord depressant and without the histamine side effects which seem to me to potentiate the shock of tetanus, is theoretically the perfect agent of treatment. I have found this to be so clinically, the only problem being in the prevention of phlebitis from constant infusion. In parallel states, such as strychnine poisoning, myanesin should be equally applicable.

The value of myanesin in true convulsive states is limited to the emergency therapy of status epilepticus. Here it may be useful. In preventing injury during shock therapy, it has been disappointing. The threshold of convulsion is raised, and the initial clonic phase softened, but this is only after large doses and not to a dramatic degree.

Since myanesin is a specific and rapidly acting muscle relaxant, we have felt it of interest to use it as an experimental tool in the clarification of the underlying neuromuscular mechanisms in acute anterior poliomyelitis.

Present day concepts of the abnormal mechanisms in poliomyelitis demand heavy expenditures in personal and funds directed toward the treatment of "muscle spasm." It is believed that muscle contractures of reversible nature account for the eventual deformities and chronic disabilities other than those due to paralysis.

In an attempt to evaluate the nature of limitation of motion in this disease patients with unequivocal clinical evidence of "muscle spasm" were chosen. Range of motion tests were done. Patients were then given relaxant doses of myanesin intravenously, since it is capable of causing specific muscle relaxation without serious or uncomfortable side effects. After injection of doses of myanesin sufficient to demonstrably relax the limb muscles, range of motion tests were again performed. It was found that increase in range of motion was of insignificant order. Pain still was severe at or near the previous end point.

This finding is interpreted as meaning that "muscle spasm" in poliomyelitis represents purposeful splinting to prevent stretching of neural elements (as in the Laségue test). As such it may represent a part of a primitive protective extensor reflex, seen at its maximum in opisthotonos, and not necessarily related to cellular response in the meninges (i. e., tetanus, strychnine poisoning).

On the basis of such data, it seems worth while to reevaluate the techniques for treatment of poliomyelitis, including hot packs, curare, etc., and the concomitant expenditures of time and effort for their application.

As I have previously stated, the usefulness of these drugs in the treatment of spasticity is reduced by their ephemeral effect and unpredictable value by mouth. In the hands of the physician interested in chronic disorders, they can still be of great value. During the short period of their effect, a careful survey can be made of range of motion at various joints, degree of muscle contracture, etc. Much important clinical information can thus be gained.

The improvement in blood supply and general health of the muscular apparatus when it is permitted to assume its normal length and range of

motion, is well known. The dividends incident to the use of muscle relaxants lie in this sphere. A fair start has been made in the drugs mentioned and many others that I have not had time to discuss. The most fascinating thing about the whole problem is the manner in which neurophysiologic, biochemical and pharmacologic data are gradually but inexorably fitting into a logical whole as the picture unfolds. Speaking clinically, the goal lies in a fairly long-acting relaxant which will act by mouth. I do not believe it is far off.

PHYSICAL MEDICINE IN ARMY HOSPITALS *

LIEUTENANT COLONEL R. H. B. DEAR, MC.

Medical Corps, United States Army

The physical medicine service in Army general hospitals is increasingly active. It is full of variety, problems and opportunities for each individual handling patients. Physical medicine in or out of the Army is, in my opinion, the broadest of specialties, and certainly in the Army it includes to the fullest extent the coordinated and integrated professional employment of physical therapy, physical reconditioning and occupational therapy in the management of the sick and wounded. Physical agents, graded physical activity and crafts are employed for prevention, diagnoses and treatment. Definite medical criteria determine their use and show better results than if not employed. The period of convalescence is quickened. In a collection of 63 war paintings, showing Army and Navy medicine in World War II, no less than one-third depicted some phase of physical medicine. This graphically indicates the practical and extensive use of physical medicine in military hospitals.

In the field of Army physical therapy, one may include thermotherapy (heat), actinotherapy (ultraviolet rays), hydrotherapy (water), electrotherapy (electric currents) and mechanotherapy (massage, mobilization, rest, exercise and exercise apparatus). Physical therapy is used first, for the prevention and treatment of contractures and deformities; second, for reeducation and strengthening of muscles; third, for the relief of pain originating in muscles and joints; fourth, for the diagnosis and treatment of peripheral vascular disease; fifth, for the rehabilitation of patients with hemiplegia, paraplegia, and cerebral palsy; sixth, for electrodiagnosis and treatment of neuromuscular disorders, such as peripheral nerve injuries and the distinguishing between upper and lower motor neuron lesions of the nervous system, and, seventh, to secure relaxation.

The occupational therapy program employs specific and nonspecific arts, skills (as printing, i. e., hand printing press) and crafts (as weaving, wood-working, knotting, braiding and clay modeling) as mediums for restoring, first of all, lost function (for example, use of a table loom) and improving coordination and skill of injured joints and muscles; second, for guiding patterns of thought activity in mental disorders (easing emotional stress, conserving work habits, giving outlets for repressed energy and developing responsibility and cooperation); third, for helping in the patient's adjustment to chronic disease; fourth, for helping in reeducation in permanent disabili-

* From the Physical Medicine Service, McCormack General Hospital, Pasadena, Calif.

ties; fifth, for aiding in mental rehabilitation by establishing rapport with the patient and maintaining morale through purposeful utilization of leisure time (the attention span is noted); sixth, for helping build up physical tolerance and endurance (for example, use of a floor loom) and increasing muscle strength (for example, use of a foot power printing press). At McCormack General Hospital, nonfunctional patients are, in general, those who will be in the hospital a minimum of three weeks. Functional patients are treated for as short a period as three days if necessary. Red Cross arts and skills corps volunteers administer the nonspecific portions of the program under close occupational therapy supervision. This includes leather working, ceramics, jewelry, copper tooling, stenciling, woodworking, plastics and minor crafts. It is primarily for bed patients.

The physical reconditioning program dynamically trains the physically handicapped to become as self sufficient as their physical limitations will permit. With the convalescent soldier, it is a process of prevention of physiologic backsliding and is directed toward the restoration of full strength and stamina through participation in a constant, progressively graded physical activity program. There are four classes of patients who receive physical reconditioning: bed patients, early ambulatory patients, advanced convalescent patients and some outpatients. The bed patients get general conditioning and resistive exercise. The early ambulant patients strive to increase endurance and muscular strength. Convalescent patients vigorously use the larger muscles of the trunk and legs, thus developing cardiovascular and respiratory endurance. To increase muscle strength, flexing of the biceps on the wall pulleys is an example. We attempt to strengthen specific muscles and improve posture and coordination and range of motion in physical reconditioning activities. Recovery is hastened through supervised active exercise. Maintenance and development of physical fitness are basic. Mere early ambulation does not of itself prevent deconditioning, we have found.

Since establishment of the physical medicine service as a major professional service two years ago, the facilities and services rendered have steadily increased. About 16 per cent of all patients in the hospital are seen by the physical medicine service. It is necessary to screen all requests for treatment and temper judgment with experience in deciding whether the patients will benefit from physical medicine procedures and when treatment should be terminated. Economically this is a necessity. From time to time the physical medicine service includes additional activities, such as a blind rehabilitation section, with trained orientors; a speech rehabilitation group, with speech therapists, and an amputee prosthesis-training section, including the Northrop National Research Council Arm project. In a larger medical center it might well include an audiologic section for the hard of hearing. A volunteer speech therapist, using patience and perseverance, has had amazingly good results with several patients with cerebral thrombosis, who had previously been stationary so far as speech recovery was concerned. We utilize as necessary the Red Cross social service worker. The educational and prevocational phase of rehabilitation is handled by the convalescent services in the Army, and there is a Veterans Administration vocational guidance man at each general hospital for World War II veterans.

Reports on local improvisations of apparatus may be transmitted, if there is sufficient merit to them, for inclusion in the monthly Army medical bulletin, which is distributed to all medical officers and departments.

Most departments of physical medicine make the best of their local situation. While it would be ideal to have the three sections — physical ther-

apy, occupational therapy and physical reconditioning — all located together, it is not possible at all hospitals. A good many are limited as to space, but efficient use is made of each allotted cubic foot. From experience, I have found that my office must be in close proximity to the physical therapy clinic, as the majority of new patients go to this clinic for treatment first. This includes the outpatients, as well as the stretcher patients from various wards in the hospital. We use the local Y. M. C. A. indoor swimming pool in the winter and our own outdoor pool during the spring and summer for graded exercise and aquatic activities. Healthy recreational special service convalescent activities, as ice skating, bowling, pitch-and-putt golf and, at some hospitals, deep sea fishing are available and are encouraged so long as they do not interfere with the planned daily physical medicine activities. Occasionally recreational activity is provided for under supervision of the physical medicine service for selected patients.

Professional standards have always been high and remain so for the commissioned officers, occupational therapists and physical therapists of the Women's Medical Service Corps, as well as for the physical reconditioning officers and the enlisted technicians for the three sections. Regular Army therapists are eligible to apply for further training in civilian institutions.

Residencies approved by the American Board of Physical Medicine and Rehabilitation and The Council on Medical Education and Hospitals of the American Medical Association in physical medicine are available at Fitzsimons, Letterman and Walter Reed General Hospitals. For the younger physicians, there is an Army plan whereby a reserve commission may be tendered and a physician may take a civilian residency on a government salary, in return for which an equivalent length of time is spent serving in the Army Medical Corps on active duty at Army installations.

The Army physiatrist has a teaching responsibility which covers a great deal of educational material. He is responsible for training the civilian occupational therapist and physical therapist students who are getting clinical training in selected Army general hospitals, in training enlisted technicians and keeping physical and occupational therapists and physical reconditioning instructors up to date in anatomy, physiology and newer concepts of physical medicine. He must be equipped to cope with the proper and adequate orientation of other departments of the hospital, including liaison with the specialty surgeons and internists, instruction in bed positioning for nurses and ward attendants, and cooperation and active membership in the local and national physical medicine and other medical societies. He should keep close liaison with the national and local chapters of the physical therapy, occupational therapy and rehabilitation organizations, as well as indoctrinate leaders of other fields of medicine. Contact is maintained with teaching hospitals of local medical schools offering courses of all types, depending on the desires of the physiatrist in charge of the physical medicine service. This contact, likewise, extends on through to the chiefs of the respective sections and their own therapists, who are encouraged to affiliate with local groups. The department of physical medicine of the Medical Field Service School, Brooke Army Medical Center, Fort Sam Houston, Texas, conducts training for physical rehabilitation and physical therapy personnel and orients other personnel on various aspects of the physical medicine service.

Local regional and sectional meetings are held from time to time at Army installations, and information is prepared frequently for public release concerning physical medicine activities. In turn, the facilities of the local teaching hospitals are made available for instruction purposes. Leaders in the

civilian physical medicine field help with a guiding hand as attending staff members and consultants in their own localities.

A Physical Medicine Consultants Division in the Office of the Surgeon General, Department of the Army, Washington, D. C., decides policy matters and keeps central control of most physical medicine activities. There is physical medicine service overseas in the new Tripler General Hospital in Hawaii, and the departments are gradually expanding in other overseas hospitals as trained personnel are sent over. In smaller station hospitals, the physical therapy clinic is under the supervision of the orthopedic service, and there are a few separate occupational therapy sections and physical reconditioning sections.

The Army physiatrist sees all his patients, writes the prescriptions as specifically as possible for each and evaluates the patients himself. The prescription includes modality, area, length of treatment, frequency and time that a patient is to be rechecked. The standard request form, WD AGO 253, is prepared in duplicate by the referring medical officer, who prescribes results to be desired and gives precautions to be followed. The patient's chart is then reviewed by the physiatrist, who looks at roentgenograms, if necessary, and makes his own history and records the pertinent physical findings. The physiatrist may or may not have one or more of his section chiefs sitting with him when he sees new patients. This depends on the physical layout of the hospital plant, and is not entirely feasible for routine new cases, as the time of the chief of the section is not utilized to the fullest if there is a scarcity of therapists. Diagnoses are arrived at and treatment is prescribed in reasonable detail.

Progress notes are written at suitable intervals, approximately ten days to two weeks, and mainly concern progress in physical therapy and occupational therapy. These are forwarded by the physiatrist to the ward for inclusion on the original Physical Medicine Consultation and Treatment Form, where the progress note is pasted or stapled onto the second page of the form. A complete record of the case is kept in the physiatrist's office, and a summarization is made upon termination of treatment. Leaves and passes from the ward are discouraged while the patient is under physical medicine treatment. Essentially, the entire treatment of patients with a certain few types of disease cases comes within the field of physical medicine and such patients, if there were adequate facilities in each hospital, could well be placed on a physical medicine ward. However, in general, the physiatrist follows each patient in the hospital, regardless of the ward, by means of weekly or even, in some cases, daily rounds. Weekly rounds are made with respective chiefs of service, particularly with the chief of the orthopedic service, the chief physical therapist, the chief occupational therapist and the head physical reconditioning officer accompanying the physiatrist. Rounds on the convalescent patients are held twice monthly, inasmuch as most patients in the convalescent section are receiving physical medicine in one form or another.

Each of the general hospitals varies somewhat in physical therapy treatment program and use of modalities, based on the personal experience of the chief physiatrist and therapists, but basically there is uniformity. High resistive exercises, with slight modification, are in use in all of general and smaller hospitals. These principles and results have definitely proved successful over the past few years. Developed in the Army by DeLorme, they were applied to poliomyelitis-weakened muscles by Huddleston, Fitzsimons General Hospital, Denver. The electromyograph, for neuromuscular evaluation, will be clinically and increasingly useful. The electromyograph com-

bines the use of cathode ray tubes (seen in television sets and amplifiers), which record visually and audibly the electrical impulses of the muscles from needles inserted into them. This instrument objectively distinguishes between upper motor and lower motor neuron lesions and distinguishes between malingering, hysteria and true organic diseases. Such an instrument furnishes immense help in the Army, where immediate diagnosis saves so much time. It is accurate in the diagnosis of nerve lesions and peripheral nerve injuries and is helpful in evaluating the functional return in such cases. The electromyograph distinguishes progressive muscular atrophy from dystrophy and fairly accurately localizes and confirms the presence or absence of a herniated intervertebral disk, whether conservative utilization exercises are indicated and whether a myelogram is necessary. This instrument produces a recorded pictorial form showing muscle action which is positive legal evidence for Army retiring boards or compensation or insurance cases. Accurate study is possible of characteristic voltages generated by normal or abnormal voluntary muscles. The eventual prognosis in affected muscles (approximately twenty-one days after the onset of poliomyelitis) as well as the rate of improvement can be determined. It quantitatively measures muscular electrical activity and records denervation fibrillation. Above all, it is useful in training patients to use their muscles after illnesses by enabling them to see and hear what is happening so that they can concentrate on contracting the right muscles during training.

Fever therapy is slowly being resumed where nursing personnel are available and the physiatrist has the time to supervise its administration closely. It will not be used as it was in the late 30's, but it will be used for shorter periods and at lower temperatures.

About a fourth of the patients seen in the physical medicine service in the physical therapy clinic are outpatients and receive about one of every sixteen treatments administered in this clinic. The physical medicine service sees about one-twentieth of the total outpatients. Patients of all ages are referred from the outpatient department. I have noted that the older patients, if given careful home instructions as to technique and how to construct simple, adequate apparatus, are less inclined to become inpatients with chronic conditions, such as arthritis. One sees even patients with cerebral palsy among the dependents of Army personnel. Entire home programs have to be plotted, with instructions to mothers as to home treatment and arrangements made for continuing with a civilian clinic, since we do not have the set-up for complete evaluation and follow-through. Among the inpatients there are veterans of World War I and World War II, as well as Merchant Marine seamen, who are admitted under the United States Public Health Service at some of our hospitals. In addition, Board Employment compensation cases and civil service cases are seen.

From the orthopedic service patients with fractures, preoperative shoulder and knee conditions and peripheral nerve injuries are referred to our service. For these patients we attempt to increase range of motion, overcome atrophy, loosen scars with cupping, relieve pain and overcome deformities, as well as to use high resistance in an attempt to build up endurance, strength and stability. There are many patients referred, both inpatients and outpatients, for low back pain, with and without radiation. We have had good results using radiant heat or diathermy approximately fifteen minutes, followed by mobilization stretching exercises and postural build-up after the acute stage, stressing the abdominal and hip muscles. For some, we prescribe galvanic ion transfer using Imadyl Ointment, containing histamine,

or Snow's Solution, containing epinephrine, and about 12.5 ma. for fifteen minutes. Many patients are referred from the orthopedic clinic for posture routine or for lumbosacral strain, including management of flatfoot. This is preventive physical medicine. We have many patients with preoperative and postoperative knee and shoulder conditions, such as ruptured tendons, histories of repeated dislocations and instability. From the medical service, we see patients with cerebral vascular conditions and rheumatoid diseases and osteoarthritis patients, for whom we individualize treatment. For the rheumatoid patient a full daily program is coordinated, and the patient is oriented as to his disease. A proper balance of non-weight-bearing rest with exercise is important. Instructive reading matter is furnished selected patients who appear to benefit by reading. Attempt is made to prevent spastic contractures by passive movement at first, using heat in various forms and massage and positioning in bed, and, later, graduated exercises with ambulation techniques, coordination and rhythm, using light balls, with counting, are employed. We have cautiously commenced using Tolserol in painful spastic neuromuscular conditions, with fair relief of symptoms in some. We are at present exploring the further possibilities of using all forms of counterirritation for painful muscular spasms. This includes erythema doses of ultraviolet rays over very small areas of skin. Microwave equipment is being tried in some of our Army hospitals.

Our underwater treatment program is given to advanced and beginning groups on a prescription basis. Types of patients receiving the treatment are those with fractured legs, shoulder conditions for which external rotation is not permitted, patients convalescing from poliomyelitis, open wound patients and neuropsychiatric patients with postoperative knee conditions. The surgical patients, requiring more than ten days in the hospital, benefit from the reconditioning exercise program. The patients with preoperative and postoperative chest conditions do well. Vital capacity, weight and unilateral chest expansion measurements are made before and after operation. Hospitals with many tuberculosis patients feature intensive occupational therapy programs. Attempt is made in all of our sections to measure quantitatively the increase in strength, endurance, skill, speed of movement, attention span, motivating forces and improvement in resistance. We are striving for new methods of expressing these rather difficult descriptions of increased health and sense of well-being. We, of course, uniformly record ranges of motion and are interested in new instruments to do this more easily. There is a close relationship between physical medicine and the application of knowledge of peripheral vascular disease and its prevention and treatment. Ambulation of aged patients after long illnesses is turned over to our service for accomplishment. Ambulation and gait training, with fitting of prostheses and supportive and assistive splints and braces in nonorthopedic conditions, are other functions of our service. For our patients with poliomyelitis, heat for spasm and pain, in the form of hot tubs or local or prone packs, is followed by stretching and muscle reeducation. Detailed muscle tests are made about every six weeks. All sorts of functional tests for daily living and self-care are performed in the later convalescent stages. Progressive resistance exercises are also utilized in the convalescent stages. An attempt is being made to protect weakened muscles through proper rest and braces, slings and supports night and day, in order to prevent early substitution by strong muscles. We seem to fulfil a therapeutic need for previously neglected musculoskeletal and neuromuscular disorders, usually chronic in nature.

Definitive physical treatment in Army physical medicine clinics requires

an understanding of work psychology, applied anatomy and applied physiology, and it is an art as well as an ever exact science. This should be true in a civilian department of physical medicine, as well as in Army clinics. Enthusiasm must be made contagious. Politeness and patience are a must in treating patients that we see daily. The patient's will to be self-sufficient needs to be constantly strengthened and "hospitalitis" overcome in the most expeditious manner possible for people who do not pay for their medical treatment. Physical medicine in Army general hospitals ties together and supplements other forms of medical practice. In the November Bulletin of the United States Army Medical Department, the statement is made that "the Physical Medicine Service has achieved full recognition along with such other auxiliary specialties as the roentgenology, anesthesiology and laboratory services." It has not only been found necessary as a diagnostic aid, but is therapeutically useful and, finally, preventive in relation to future physical or mental disabilities. Physical medicine rehabilitation is, as Boynton has so aptly expressed it, "restorative medicine."

COMMITTEE REPORTS AMERICAN CONGRESS OF PHYSICAL MEDICINE *

Report of The Committee on Cooperation with the Army, Navy, Public Health Service and Veterans Administration

Cordial and cooperative relationships have continued to flourish between the Physical Medicine Services of the Army, Navy, Public Health Service and the Veterans Administration. This specialty has made steady progress in these governmental agencies and there is mutual interest and endeavor in the continued development and expansion of this field along sound scientific lines. In keeping with the official change in title and scope of the American Board of Physical Medicine to the American Board of Physical Medicine and Rehabilitation, and of the Council on Physical Medicine to the Council on Physical Medicine and Rehabilitation and the broader concepts implied therein, these agencies stand ready to implement, each within its own objectives, the fuller implication of work in this specialty as described in recent publications of the American Medical Association.

As governmental agencies, the Army, Navy, Public Health Service, and Veterans Administration have objectives in Physical Medicine and Rehabilitation for accomplishment in an efficient and ethical manner, which are more or less common one with the other. These objectives are always primarily concerned with the best interests of the patients, and therefore necessarily include the recruitment and training of physiatrists, therapists and other

personnel; the Board certification of physicians engaged in physical medicine and rehabilitation in the government services; the establishment of scientific research projects in keeping with current needs and for the steady advancement of this specialty; the development, expansion, and successful administration of residency programs in Physical Medicine and Rehabilitation (Army and VA); and the recruitment of a sufficient number of residents. Always with a view toward national preparedness and the very best care as rendered by this specialty for the public citizenry, the Armed Forces and our veterans, there is emphasized the urgent necessity of having excellent Physical Medicine and Rehabilitation facilities in the medical services of these governmental agencies at all times.

The Chairman has received reports of progress and recommendations from various members of the Committee. All these reports have been favorable and encouraging.

Governmental agencies have established affiliation with Class A medical schools and with approved schools of physical therapy and occupational therapy which has made possible excellent teaching programs, initiation of residencies, and organization of clinical practice for therapists. Research is being established at several governmental hospitals and installations under the supervision of qualified physiatrists utilizing the services of capable therapists and trained technical personnel. The emphasis in all therapy in this field is that it be made purposeful, functional and progressive. Vocational objectives continue to be considered in the over-all rehabilitation plan, and

* Committee reports will appear in this and succeeding issues until all received have been published.

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ARCHIVES of PHYSICAL MEDICINE

OFFICIAL PUBLICATION AMERICAN CONGRESS OF PHYSICAL MEDICINE

∴ EDITORIALS ∴

AMERICAN BOARD OF PHYSICAL MEDICINE AND REHABILITATION

The next examinations for the American Board of Physical Medicine and Rehabilitation will be held in Boston, August 26 and 27, 1950. The final date for filing applications is April 1, 1950. Applications for eligibility to take the examinations should be mailed to the Secretary, Dr. Robert L. Bennett, Georgia Warm Springs Foundation, Warm Springs, Georgia.

AMERICAN SOCIETY OF PHYSICAL MEDICINE

Attention is called to those who may want to file applications for consideration for membership in the American Society of Physical Medicine. As of January 1, 1950 all applicants for membership must be certified to the American Board of Physical Medicine and Rehabilitation.

MEDICAL CARE IN OUR DEMOCRATIC NATION

Despite all the discussion on compulsory health insurance and socialized medicine, the first session of the Eighty-first Congress closes with a record on health legislation of one bill passed by both houses and sent to the White House for approval. This bill, S.614, doubles the annual federal contribution for hospital expansion and otherwise liberalizes the Hill-Burton Act. However, in January, members of Congress will be back in Washington for a new session and it is predicted that the Senate next January will probably plunge right into a discussion of the pros and cons of national health insurance. It behooves all of us as physicians to keep informed and to combat the trend toward collectivism and statism in our federal government.

In the world as a whole, there is a definite trend toward a political shift to the left. The United States stands out as almost the only country which does not have some form of compulsory health insurance, socialized medicine or state medicine. Undoubtedly during the next session of Congress there will be much discussion of the bill, supported by the present administration, to provide a national health act. This bill, known as the Thomas Bill (S.1679), provides for health taxation that is compulsory for nearly everybody and that is controlled from Washington. It would cost this nation at least 6 billion dollars a year. It would make practically all physicians subject to bureaucratic control by the Federal Security Agency. Even though it is important to make every possible effort to improve medical care in this country, compulsory and bureaucratic control of medical care is not likely to improve the health of our nation.

There are two major trends on the part of our national legislators which every thinking American citizen should combat. One is the trend to raise

federal taxes and to expend them indiscriminately and the other is to center more and more power in the federal government. In 1932 the federal share of taxes was 22 per cent and the share of the state and local governments was 78 per cent; but by 1948 the federal share was 75 per cent and the state and local share only 25 per cent.

Despite this high taxation which will give the federal government an estimated 1949 income of 40 billion dollars, the government has a budget of 42 billion dollars for 1949 and is considering excessive additional expenditures in public housing, federal aid to education, expanded social security and socialized medicine. Also, the federal debt has reached 276 billion dollars. If you had a debt of \$27,600, an anticipated yearly income of \$4,000 and an annual budget of \$4,200, would you plan to build a new house (public housing), spend more for education of your children (federal aid to education), spend more for protection of your old age (expanded social security cover), and also spend more for health and accident insurance (socialized medicine)? Or would you decide that you were "broke" and that everyone in your family would have to go to work. It has been pointed out that "The downfall of every great country since the beginning of time has been caused by the financial unsoundness of government."

Also we must combat the tendency toward centralization of power in our federal government. American citizens are the chief proponents of the system of individual competitive free enterprise. If we weaken our support of this successful economic system, all the other free nations of the world will crash with us. We are being urged to accept a new economic system which allegedly will provide us with greater security through compulsory health taxation but this type of economic system has failed miserably in countries where it has been tried.

It has been said that "He who seeks security through a surrender of liberty loses both." Harvey Firestone has said, "Nobody in this world is more secure than the man in a penitentiary but he is not free to go and come as he pleases. He is watched, guarded and disciplined." The only real security lies in liberty and opportunity! No beast is more secure than the cow, which led Harry Grannatt to write the amusing poem:

Consider the cow
With her poise and urbanity
Doing her share
Of the work of humanity;
Having no duties
Beyond her ability,
Hers is a world
Of the utmost stability.
Cared for by others
From youth to maturity —
A perfect example
Of Social Security.

But who wants to live the life of a convict or of a cow in order to achieve a dubious security!

We Americans do not want a paternalistic form of government on which to lean for security. "Real and lasting security can be more soundly acquired through the American system of competitive free enterprise." We Americans want to follow the well-tried and highly successful voluntary way, not a costly

bureaucratic compulsory system.

Recently Mr. Basil O'Connor, while President of the American National Red Cross, said: "The existence in society of strong, robust, active, voluntary groups is one of the best guarantees against the affirmative state indulging itself in illusions of omnipotence."

Herbert Hoover has pointed out that "The world is in the grip of a death struggle between the philosophy of Christ and that of Hegel and Marx. The philosophy of Christ is a philosophy of compassion. . . . The day we decide that the government is our brother's keeper, that day the spirit of compassion will have been lost."

Republicans and Democrats alike have spoken out against the tendency of our national legislators to provide an alleged security by sacrifice of personal liberties. James F. Byrnes has said, "If some of the new programs seriously proposed should be adopted, there is danger that the individual, whether farmer, worker, manufacturer, lawyer or doctor, soon will be an economic slave pulling an oar in the galley of the state. . . . We should not have the federal government regimenting our lives from the cradle to the grave."

Although the administration's bill for a national health act was not passed during the first session of this Congress, undoubtedly it will be considered again next January. The trend toward centralization of power in our national government, excessive spending of the people's money, and compulsory taxation of our citizens for their alleged "welfare" has not been completely checked. It is to be hoped that our legislators will be wise enough to provide for the welfare of our nation and the health of our citizens by means of a well-devised voluntary plan. It is certain that by working together, legislators and physicians could develop a program which would provide for adequate medical protection of our population without destruction of our system of free enterprise. Now is the time for every physician to remain vigilant and to seek for the right program in solving the national health problems. Now is the time for all of us to voice disapproval of excessive governmental spending and of inordinate centralization of power in the federal government.

Years ago Thomas Jefferson said, "To preserve our independence, we must not let our rulers load us with perpetual debt. . . . If we can prevent the government from wasting the labors of the people, under the pretense of caring for them, they will be happy."

Free enterprise is the backbone of the American democratic system, and compulsion, as a means of improving our national health or for any other reason, is abhorred by free Americans. Let's avoid the easy road and weak policy of being herded like cattle to obtain a supposed security which may turn into dependence. Let's revive the pioneering American spirit of strength and independence. Let's fight compulsion, excessive spending, and centralization of power in our national government. Let's keep America and each of its citizens free, and strong and independent!

FRANK H. KRUSEN, M.D.



(Continued from page 726)

the resocialization and adjustment of the patient is a part of the therapeutic program.

Physical Medicine and Rehabilitation in all governmental services has the same common objectives: (1) to shorten the period of hospitalization and convalescence, (2) to reduce the possibility of readmission, and (3) to return the individual to duty or a job in the shortest possible time.

Liaison between civilian and government hospitals has been very good and is becoming even better with the increasing activities, influence and recognition of Physical Medicine and Rehabilitation as a specialty and as a consultant service. This cooperation has resulted in an excellent interchange of ideas and a broadening of the scope of the professional services in the participating hospitals.

The problem of recruitment of physicians and medical officers interested in Physical Medicine and Rehabilitation from a career standpoint remains a critical one for the government hospitals. However, more interest is constantly being developed so that younger and additional physicians are entering and exploring this field for future career possibilities. With establishment of Physical Medicine and Rehabilitation in the curriculum of an increasing number of medical schools, the development of residencies in this specialty in government hospitals, and the organization of schools of training in Physical Medicine and Rehabilitation in government, services offering intensive and comprehensive courses for periods varying from a few weeks to six or more months, the problem of recruitment may become less acute.

All governmental agencies have cooperated in the development and presentation of scientific exhibits in Physical Medicine and Rehabilitation when the opportunity presented itself. Various governmental agencies have been represented in the Special Exhibit on Physical Medicine and Rehabilitation at the Annual and Interim Sessions of the American Medical Association.

Publication and distribution of pamphlets, books and other visual aids media, including the development of educational and training films, have been accomplished by several of the government agencies.

It is reported that the organization of Physical Medicine in the Department of the Army remains the same as during the past two years. A Physical Medicine Service is established as a major service in eleven (11) general hospitals. Three of these hospitals, namely, Walter Reed, Letterman and Fitzsimons, have been approved for residency training in physical medicine, and there are now three residents in each of these hospitals. Army regulation 40-705, dated June 16, 1949, sets up this service permanently in its present form and includes provisions for wards for the Service when indicated. The Surgeon General has approved of the concept of Physical Medicine which includes physical therapy, occupational therapy and physical reconditioning under the supervision of trained

physiatrists. In station hospitals, physical therapy, occupational therapy and physical reconditioning are combined into a Physical Medicine Section and placed under an appropriate major service. The paramount desire of Army physiatrists is to keep Physical Medicine a clinical specialty.

It is reported from the Physical Medicine Branch, Department of the Navy, that there have been no changes in the organization of the Physical Medicine Service during the past year. Amputation Centers are maintained at the Naval Hospitals, Philadelphia, Pa., and Mare Island, California. Continued progress is being made in the research and development of artificial limbs in the Department at Mare Island in collaboration with the University of California. An Aural Rehabilitation Center is maintained at the Naval Hospital in Philadelphia where lip reading, speech correction, retraining residual hearing and psychosocial and vocational rehabilitation are carried out. The Navy is confronted with a critical shortage of physiatrists.

A report from the Physical Medicine and Rehabilitation Service Section of the Public Health Service indicates no change from the previous organizational arrangements. Recruitment of therapists is very difficult. Included is a statement of good inter-agency cooperation which has proven very successful for the Public Health Service, namely, the cooperation of the VA in permitting the Chief, Physical Medicine Rehabilitation at VA Hospital, New Orleans, to be consultant to the U. S. Marine Hospital at Carville, La., in the study of physical therapy and occupational therapy effect on peripheral nerve lesions in Hansen's Disease. This is the first time, as far as is known, that such a study has been undertaken and after a period of seven months, it appears that promising results will be forthcoming.

In the Veterans Administration the Physical Medicine Rehabilitation Service became a Division in November, 1948, and as such is a part of the Professional Services, thus coming under the jurisdiction of the Assistant Medical Director for Professional Services. The organization of this Service has not changed, and consists of Physical Therapy, Occupational Therapy, Corrective Therapy, Educational Therapy, Manual Arts Therapy, Rehabilitation for the Blind, and Rehabilitation for the Hard of Hearing. All or a part of these sections make up the Physical Medicine Rehabilitation Service in 128 hospitals and approximately 40 regional offices throughout the United States. In twenty-six (26) selected General Medical and Surgical Hospitals, Physical Medicine and Rehabilitation wards have been inaugurated, with the number of beds assigned varying with the size of the hospital and the patient load in physical medicine and rehabilitation. A similar plan is being studied for implementation in selected Tuberculosis Hospitals. A second special three-month training course in Physical Medicine and Rehabilitation was conducted at the VA Hospital, Hines, Illinois, for eighteen (18) physicians. Two

in-service training schools were held for corrective therapists, one for educational therapists and one for manual arts therapists. The Blind Center at the VA Hospital, Hines, Illinois, completed a year's operation and assumed the position of national leadership in the field of remedial training and rehabilitation for veterans with impaired vision. Additional Audiology Clinics for the rehabilitation of veterans with impaired hearing are being established. There are twelve approved residencies in Physical Medicine and Rehabilitation in VA Hospitals, with only approximately seven residents on duty. The critical need for more residents is second only to that for qualified, full-time physiatrists.

It has been suggested that some method be devised through which one service can find out from another the real evaluation of an individual who wants to transfer without the usual rather long waiting period to get this information. It has been further recommended that some method be developed by which rehabilitation personnel and therapists could be exchanged between the services for periods of from one to three months for the mutual benefit of the services and the personnel concerned.

It has been suggested that there be included in the name of the Committee the words, "Air Force," so as to have the scope of this Committee encompass the Department of Physical Medicine and Rehabilitation of the Air Force. The Air Force now has a separate Medical Department and intends to include in its activities a thorough and complete physical medicine and rehabilitation program. Planning is under way for the establishment of an Aero-Medical Center which will include departments of research, education and clinical facilities.

Whereas no special problems have been referred to this Committee the members of this Committee are ready to help in the solution of any difficulties which are within its jurisdiction.

It is recommended by this Committee that the name be changed so as to include the Air Force.

In conclusion, it is evident that considerable progress in the common advancement in physical medicine and rehabilitation in the various governmental services has been made during the past year.

This report is made in accordance with Chapter V, Section 10 of the By-Laws of the Constitution of the American Congress of Physical Medicine.

A. B. C. Knudson, M.D., Chairman.
Benjamin A. Strickland, Jr., M.D.
Richard H. B. Dear, M.D.
C. C. Troensegaard, M.D.
A. William Reggio, M.D.

Report of the Committee in Cooperation with the Food and Drug Administration

During the past year the Committee has continued its activities in assisting the Food and Drug Administration with particular regard to the labeling of physical devices to the general public. In cooperation with the Council on Physical Medicine and

Rehabilitation, the Committee has recommended minimal acceptable standards for labeling of certain devices now under review by the Food and Drug Administration. The group has functioned as consultants to the Food and Drug Administration in many instances where the opinions of a trained physiatrist, either individually, or as a consensus of the group, are requested by the Food and Drug Administration. During the past year, the consensus of the Committee regarding the minimal standards for labeling of infrared lamps was accepted by the Council on Physical Medicine and Rehabilitation and published in the *Journal of the American Medical Association*. Similar reports, dealing with other devices sold to the general public, are in the process of study at present.

Charles S. Wise, M.D., Chairman
Harold Dinken, M.D.
Sedgwick Mead, M.D.
G. J. P. Barger, M.D.
Fred B. Moor, M.D.
Richard Kovács, M.D.
Everill W. Fowles, M.D.
Nathan H. Polmer, M.D.

Annual Report of the Committee to Foster and Encourage Research

This Committee had hoped to function as an advisory group to any physicians seeking to start a research project in the field of Physical Medicine and Rehabilitation, its members being of wide geographical distribution and with previous experience in research work. It is, of course, impossible for this Committee to support directly any research projects, as funds for this purpose are not available. No inquiries were directed to the Committee so that there is nothing to report in that direction.

It is perhaps of some interest to the members of the Congress to realize that considerable research activities are progressing in various parts of the country in our field. For example, between the period of 1945-48, 133 papers on basic or clinical research were published from centers or individuals aided by grants from the Baruch Committee on Physical Medicine. Many other reports have come from departments of physical medicine aided by grants from the National Foundation for Infantile Paralysis and then, as you know, many noteworthy contributions have been made from the group at the Mayo Clinic. In addition, most university-connected departments of physical medicine have made contributions in recent years to the scientific literature of physical medicine. The Committee feels that the importance of research cannot be over-emphasized and it continues to stand ready to offer whatever aid it can to individuals seeking information concerning research in Physical Medicine and Rehabilitation.

Arthur L. Watkins, M.D., Chairman.
William Bierman, M.D.
Frances A. Hellebrandt, M.D.
Herman Kabat, M.D.
H. Worley Kendell, M.D.

MEDICAL NEWS

New York Society of Physical Medicine

The regular monthly meeting of the Society was held Wednesday evening, October 5, in the New York Academy of Medicine Building. The scientific program consisted of a presentation of reports of the annual session in Cincinnati of the American Congress of Physical Medicine. Part of the evening was set aside for a demonstration of an ultrasonics machine.

The regular meeting for November is scheduled for Wednesday, November 2. The scientific program will consist of a film presented by Dr. René Cailliet, entitled "Rehabilitation and its Rationale in Multiple Sclerosis."

Year Book of Physical Medicine and Rehabilitation

At the insistence of physicians particularly interested in this field, this volume is being issued once more. As will be noted there has been a change in name. "Physical Medicine" will be edited by Frank H. Krusen, M.D., Mayo Foundation, University of Minnesota. "Rehabilitation" will be edited by Howard A. Rusk, M.D., New York University. Associate editors are George G. Deaver, M.D., New York University; Earl C. Elkins, M.D., Mayo Clinic, and Winfred Overholser, M.D., St. Elizabeth's Hospital, Washington, D. C. The new editors will survey the increasingly numerous problems involved in physical medicine and rehabilitation today, and offer valuable facts and advice which can serve as a guide to and the handling of clinical work. The new Year Book of Physical Medicine and Rehabilitation will be published in March, 1950.

Meeting Announcements

National Society for Crippled Children and Adults. — "Achieving Goals for the Handicapped," was the theme of the annual convention held in New York City, the week of Nov. 7. Among those appearing on the convention program were Anton J. Carlson, Ph. D.; George G. Deaver, M.D.; Leslie B. Hohman, M.D.; Frank H. Krusen, M.D.; George F. Lull, M.D.; William C. Menninger, M.D.; Meyer A. Perlstein, M.D., and Howard A. Rusk, M.D.

Michigan State Medical Society. — The schedule for the annual session for the next three years is announced as follows: 1950, week of Sept. 20, Detroit, Mich.; 1951, week of Sept. 23, Grand Rapids and 1952, week of Sept. 22, Detroit.

Ohio Society for Crippled Children, Inc. — "What We Do and How We Do It," was the theme of the annual session held October 16 and 17 in Columbus, Ohio.

College of American Pathologists. — The third

annual meeting of the College was held in Chicago, October 11 and 12, 1949.

Diathermy in the Home

Attempts to revive interest in home use of diathermy apparatus are being made by the New Diathermy Company, of which the William D. New Company is said to be the exclusive sales agency. Newspaper advertisements and letters to physicians and masseurs in the Chicago area are the first steps. The newspaper advertisement includes the following "Note to Doctors":

Our purpose in introducing the New Shortwave Diathermy Unit is to provide a service for the Doctor and his patient where diathermy is indicated. Under no circumstances will our unit be sold before proper diagnosis has been obtained from a Doctor of the patient's own choosing, or one provided by our company. That is our pledge to the Medical Profession.

This might seem a purely altruistic effort to discourage self diagnosis and self treatment, but printed in a newspaper it invites the patient to put pressure on his physician to prescribe home diathermy. The "Note to Physicians" seems to be an insolent, published assurance that the medical profession will share in the profits from the device. Further promotional literature includes personal letters addressed by the firm to physicians. One of these astonishing communications follows:

We are about to appoint an examining doctor for the area in which you are located to perform the services covered in the statement "NOTE TO DOCTORS" in the attached newspaper advertisement. This service is provided only through doctors, for which we pay the doctor a fee ranging from \$7.00 to \$50.00.

If you are interested in handling this work for us, will you please sign the attached card and mail it to us. We will then have an authorized technician get in touch with you to explain patient examination and diagnosis forms, as well as to outline the type of services required and the remuneration involved.

The Council on Physical Medicine and Rehabilitation has repeatedly declined to include home diathermy apparatus in its list of accepted devices. Self treatment with diathermy apparatus should not be encouraged, as was pointed out in *The Journal* (133:541 [Feb. 22] 1947). The violation of ethics by this kick-back arrangement is clear. — (Rep. J. A. M. A. 141:394 [Oct. 8] 1949).

William D. McFee

Dr. William D. McFee, formerly director of the physical therapy department of Walter Reed General Hospital, Washington, D. C., died September 7, at the age of 74. He was a former vice-president of the International Congress of Physical Therapy and was at one time president of the American Academy of Physical Therapy, of the American Electro Therapeutic Association and of the New England Society of Physical Medicine. He had held the rank of major in the United States Army Medical Corps in World War I.

BOOK REVIEWS

FRACTURES. By *Paul B. Magnuson, M.D., F.A.C.S.*, Professor of Bone and Joint Surgery and Chairman of the Department, Northwestern University Medical School; Attending Surgeon, Passavant Memorial Hospital and Wesley Memorial Hospital, Chicago; and *James K. Stack, A.B., M.D., F.A.C.S.*, Assistant Professor of Bone and Joint Surgery, Northwestern University Medical School; Attending Surgeon, Passavant Memorial Hospital and Cook County Hospital, Chicago. Fifth Edition. Cloth. Pp. 537 with 323 illustrations. Price, \$7.00. J. B. Lippincott Company, E. Washington Square, Philadelphia 5, 1949.

The new fifth edition of this authoritative reference on the treatment of fractures is revised and brought up to date in the light of newer knowledge in the field. A new chapter is included on the so-called "farmyard" reduction of fractures, covering certain simple methods of treatment that the authors feel may be used under almost all circumstances. There is a thorough consideration of the newer concepts of early ambulation. According to the author it was clearly demonstrated during World War II that suspension traction is still the method of preference. Suspension traction may require more personal supervision by the surgeon than other methods because it has to be watched closely to see that it remains true suspension and traction until union occurs. The same muscle exercises and joint movements can be carried out in most instances with suspension traction as with pins and wire. Physicians will be interested in reading the chapters written by Dr. John S. Coulter, on "Physical therapy in the treatment of fractures" and "Exercise in the treatment of fractures." These chapters have been revised and brought up to date. The detailed material on the treatment of fractures together with the descriptions of fundamental procedures make the book widely acceptable.

ZINC IONS IN EAR, NOSE, AND THROAT WORK. By *A. R. Friel, M.D., F.R.C.S.I.* Cloth. Price, \$2.00. Pp. 60 with 42 illustrations. John Wright and Sons, Ltd., 42-44, Triangle West, Bristol 8, England; Williams & Wilkins Company, Mt. Royal and Guilford Aves., Baltimore 2, 1948.

The author has been known for his work in ion-transfer since an earlier, larger volume on "Electric Ionization" published almost thirty years ago. He was a student of Stephan Leduc of Nantes, who was the originator of the present-day methods of ionization and whose picture faces the title page of the present monograph. The physics of the earlier edition are condensed in Chapter I of this volume. The author is evidently still a firm adherent to the battery current and water rheostat, evolved by Leduc half a century ago, for there is no mention made

that most of the present day galvanic apparatus use rectifier tubes. Chapter II presents the time-honored application of zinc ionization and zinc "electrolysis" in chronic otorrhea. For good measure two pages are added on treatment of hay fever, asthma and vasomotor rhinitis with zinc ionization, for which the author gives credit to a Mr. Philip Frank in and to Dr. Clarke. The last chapter presents zinc electrolysis for destroying tissue in the nose and throat, using a zinc wire or electrode to coagulate tissue around it. The author recommends the destruction of tonsil by this method, the technique recommended being to insert a special tonsil electrode in the anaesthetized tonsil for 15 minutes from the positive pole and then reverse the current for 20-30 minutes. British patients evidently must be a sturdy lot. 41 sketches illustrate physics and techniques.

LECTURES ON REGIONAL ORTHOPAEDIC SURGERY AND FUNDAMENTAL ORTHOPAEDIC PROBLEMS. — Number II. Selected from the Instructional Courses of the Fourteenth Annual Assembly, Chicago, January 25-30, 1947. Edited by *James E. M. Thomson, M.D.*, and *Walter P. Blount, M.D.* Pp. 255. Price, \$7.50. Edwards Brothers, Inc., 300 John St., Ann Arbor, Michigan, 1948.

The publication of the instructional courses of the American Academy of Orthopaedic Surgery is an excellent educational medium for the use of young orthopaedic surgeons in training for their specialty boards. No attempt has been made to give complete coverage of the individual topics discussed, but rather to present the latest information available direct from the research or clinical laboratory. The book is well printed on heavy paper and includes numerous well reproduced photographs, drawings, charts and tables. Practicing orthopaedic surgeons should find this a valuable refresher course.

JUVENILE RHEUMATISM. By *G. E. M. Scott, M.B., L.R.C.P., L.R.F.P.S.*, Honorary Medical Clinical Associate, Royal Melbourne Hospital, Melbourne, Australia. Cloth. Price, \$4.00. Pp. 163. W. Ramsay (Surgical) Pty., Ltd., 340 Swanston St., Melbourne C. 1, 1948.

Juvenile rheumatism is the term generally used for rheumatic fever by the British and Australian physicians. Dr. Scott is an Australian pediatrician who has been interested in this disease for many years and has observed and studied patients in a very active service at the hospitals in Melbourne. This short monograph should appeal to investigators of this rheumatic disease because it is a good critical review of the more recent knowledge on

rheumatic fever plus the personal views of the author. His conception and management may or may not receive the approval of all the American clinicians; however, this is wholesome and not the least derogatory. The author has had sufficient experience and has given enough thought to this disease to be entitled to respect.

The author considers all the various aspects of the disease and emphasizes them with numerous and lengthy case reports. Three pages are contributed by Miss Mahel MacKay, the social worker at the hospital, in consideration of what would be termed rehabilitation. This is little enough space for this important part of the care but shows an understanding of the problem and an effort to employ a sufficiently comprehensive program. Complete rehabilitation and all that that implies has long characterized the British management of rheumatic fever patients to the envy of the American physicians.

OPERATIVE TECHNIC IN SPECIALTY SURGERY. Edited by Warren H. Cole, M.D., F.A.C.S., Professor and Head of the Department of Surgery, University of Illinois College of Medicine; Director of Surgical Service, Illinois Research and Educational Hospitals, Chicago. Introduction by Allen O. Whipple, M.D., F.A.C.S. Cloth. Pp. 725, with illustrations. Price, \$14.00. Appleton-Century-Crofts, Inc., 35 West 32nd Street, New York 1, 1949.

The list of contributors to this text is sufficient evidence for recommending this book for the use of any physician who wishes to devote himself to surgery. This is a companion volume to Cole's *Operative Technic in General Surgery*. The operative technic that these actively busy and well-known surgeons use are clearly stated and described in detail. In his introduction Dr. Allen O. Whipple directs attention to certain useful features of the book. Among the contributors are Carl E. Badgley, Fremont Chandler, Frank D. Dickson, John M. Dorsey, Reginald H. Smithwick and R. Glen Spurling. This book with its companion volume is intended for general surgeons and physicians training for surgical practice.

OPERATIVE TECHNIC IN GENERAL SURGERY. Edited by Warren H. Cole, M.D., F.A.C.S., Professor and Head of the Department of Surgery, University of Illinois College of Medicine; Director of Surgical Service, Illinois Research and Educational Hospitals, Chicago. Introduction by Frank H. Lahey, M.D., F.A.C.S. Cloth. Pp. 951, with illustrations. Price, \$16.00. Appleton-Century-Crofts, Inc., 35 West 32nd Street, New York 1, 1949.

This book has the great advantage of having the various subjects presented by men who have had experience with the particular subject about which they write. The field of surgery today is so wide and surgery itself is so complex that no one is capable of great technical expertness, really based on a large experience, except in a relatively limited number and types of operative procedures. Such phases as anatomy, physiology, indications and pre-

cautions have also been presented in at least slight detail so that the young surgeon will not get the idea that perfection in technic is so important as to displace other phases of surgical knowledge. The twenty-one chapters and their contributors are: Wound healing and the care of wounds, Edward L. Howes; Hemorrhage and shock, John D. Stewart; Burns, Charles C. Lund and Stanley M. Levenson; Preoperative and postoperative care, Robert Elman; Amputations, Francis M. McKeever; The face, mouth and jaws, James B. Brown and Frank McDowell; The Esophagus, W. E. Adams; Abdominal incisions, Frederick A. Coller and Kenneth MacLean; Surgery of stomach and duodenum; Gastric vagotomy in the treatment of peptic ulcer, Walter Walters and Lester R. Dragstedt; Surgery of the small intestine, Clarence Dennis; The pancreas and adrenal, Alexander Brunswick; The gallbladder and bile ducts, Warren H. Cole; The liver and subphrenic space, Alton Ochsner and Michael DeBakey; The colon and appendix, Roscoe R. Graham and Jessie Gray; The lower part of the sigmoid, the rectum and anus, Claude F. Dixon and A. Lee Lichtman; Lymphatic system, spleen and portal hypertension, R. K. Gilchrist, W. H. Cole and Nathan A. Womack; Abdominal hernia, Edwin P. Lehman and Charles E. Davis, Jr.; The breast, Thomas G. Orr; The thyroid and parathyroid glands, John deJ. Pemberton and B. Marden Black; The muscles, fasciae tendons and bursae, Harrison L. McLaughlin; The blood vessels, Daniel Elkin and Michael DeBakey; Surgery of the hand and its tendons, Harvey S. Allen and Sumner L. Koch and The skin and subcutaneous tissue, Frank Glenn.

GERMAN-ENGLISH MEDICAL DICTIONARY. Compiled by F. S. Schoenwald, M.D. Cloth. Price, 27s.6d. Pp. 241. H. K. Lewis & Co., Ltd., 136 Gower St., London, W. C. 1. The Blakiston Co., 1012 Walnut St., Philadelphia 5, 1949.

Besides purely medicotechnical terms this dictionary lists many words from the lay language which are frequently used in medical literature. This work is not simply a glossary giving the equivalent words in the two languages; but rather, following the example of the Oxford Dictionaries, it is a phrase dictionary illustrating the varying shades of meaning of a word or expression by giving suitable examples of its use. According to the author he has read through about 30,000 pages of Anglo-American medical literature, translated all the words contained therein into German and so built up the dictionary's first part. Taking the German words thus gained and readjusting them to the original English words he has obtained the second part of the dictionary, the German-Anglo-American section.

THE REHABILITATION OF THE HEMIPLEGIC. Copyright, 1949 by Filmstrips, Inc. Prepared by the Department of Rehabilitation and Physical Medicine, New York University, College of Medicine.

This 35 mm. film strip consists of 40 photographs in black and white for projection on a screen. The

information needed for making a complete presentation before a class is given on 7 pages of accompanying mimeographed text. The subject is limited to the physiotherapeutic aspects of the hemiplegic. Several views show how footboard, sandbags and other devices are used to insure good position in bed. Passive and active exercises for the patient in bed are shown in a series of 14 views. The technic of starting ambulation is then illustrated, and the closing views show the resumption of the activities of daily living, such as stair climbing and the putting on of shoes. The strip with accompanying explanatory material should prove valuable in the teaching of nurses, physical therapy technicians and medical students. It would also be suitable for showing at gatherings of physicians and hospital personnel generally.

THE THEORY OF PLAY. By *Elmer D. Mitchell*, Ph.D., Professor of Physical Education, University of Michigan, and *Bernard S. Mason*, Ph.D. Revised and enlarged edition. Price, \$4.50. A. S. Barnes and Company, 67 West 44th Street, New York 18, N. Y., 1948.

Play or recreation in our present civilization has obtained a position of established importance, has considerable commercial significance, and is even related to political and military aims. To the student an investigation of the psychologic factors is of considerable interest. The physician also, or at least the psychiatrist and physiatrist, has a definite interest in recreation as a therapeutic agent for a large variety of hospitalized patients. This book represents a scholarly analysis of the subject suitable for serious lay students and teachers. Part One gives the historical background and Part Two the theory of play, including the important psychologic aspects. The latter are more fully expounded in the third section dealing with the need for play. The final 200 odd pages are devoted to technics and administration of play. This book is not concerned with the utilization of play or recreation in a hospital rehabilitation program but is recommended as a text for physical education students.

A SYNOPSIS OF PHYSIOLOGY. By *A. Rendle Short*, B.Sc., M.D., F.R.C.S. Late Professor of Surgery, University of Bristol; Late Examiner for the Primary F.R.C.S., C.L.G. Pratt, O.B.E., M.A., M.D., M.Sc. Lecturer in Mammalian Physiology, University of Cambridge, Fellow of Christ's College, Cambridge and C.C.N. Vass, M.Sc., Ph.D., Ch.B. Reader in Physiology in the University of London. Fourth Edition. Cloth. Price, \$6.00. Pp. 346, with 23 illustrations. Williams & Wilkins Company, Mt. Royal and Guilford Aves., Baltimore 2, 1948.

This is a small book which presents in outline form, the most important aspects of human physiology. The first edition appeared in 1927, and according to the preface of this edition, in order to revise this latest edition and bring it up to date, the senior author secured the help of

other two authors. This type of book should be helpful to students, physicians preparing for Board examinations and others who wish a rapid review of modern physiology.

THE SKIN PROBLEM FACING YOUNG MEN AND WOMEN. By *Herbert Lawrence*, M.D., Diplomate, American Board of Dermatology. Paper. Pp. 70. Price, \$1.50. Timely Publications, 303 Sutter St., San Francisco, 1948.

The causes of acne and treatment of acne, as known to the medical profession today, comprise a subject that should be understood by every young man and young woman as well as his or her parents. Acne is a problem which affects both personality development as well as physical appearance. Depending on the individual concerned, it can be the cause of considerable unhappiness. The author set out to explain in popular language the facts and fallacies about this most common of all skin disturbances and what can be done about it by the individual and by the dermatologist. He follows a broad approach and has no pet therapy to expound. Two excellent chapters deal with emotional problems and self consciousness about acne. This is an informative little volume and should serve its purpose well.

AN OUTLINE OF ARABIC CONTRIBUTIONS TO MEDICINE AND THE ALLIED SCIENCES. By *Amin A. Khairallah*, B.A., M.D., F.A.C.S. Paper. Pp. 228, with illustrations. American Press, Beirut, Lebanon, 1946.

This book is not an exhaustive study of Arabic contributions to medicine but a simple introduction to the subject. Rules pertaining to hygiene, baths, drinking were given. Most of them were probably of Jewish origin. Dry and wet cupping were used extensively. Our knowledge of Arabic medicine is gleaned chiefly from Arabic sources as the Arabs were their own historians. Very few of them, however, tried to write from a critical point of view. The Arabs were profuse writers on hygiene and prophylaxis. The cure of disease was a secondary aim of medicine. A whole section of the *Kitab al-Maliki* of al-Majusi consisting of 19 chapters was devoted to hygiene. The Arabs were the first to treat the mental defective in a humane way. Iba Sina wrote an excellent description of hemiplegia and gave a clear distinction between facial paralysis of central origin and of local origin.

The impression that Moslem women were chattels in the hands of their lord and master is far from the truth. In medicine several women gained distinction. Bathing with cold water is frequently quoted. "The patient should be free from indigestion, nausea and vomiting; should not be suffering from insomnia and inflammations; be neither too young nor too old. Bathing with cold water may be used after the use of hot water in order to strengthen the skin and preserve the instinctive heat in which case the water should not be very cold but of moderate temperature. It may also be used after

exercise in which case it should be preceded by massage. After exercise cold water should be used so as to cover the whole body at one time. The bather should stay in as long as his strength can support and get out before he gets chilly. On coming out of water he should be massaged. If his color and natural heat return quickly then the bathing was proper and beneficial. If the return of the color and body heat are slow, then we know that he stayed too long. He who wishes to use cold water bathing should do it gradually and should commence on the hottest summer day. He should not use cold baths after coitus or after the intake of food."

PHYSICIANS HANDBOOK. By John Warkentin, Ph.D., M.D., and Jack D. Lange, M.S., M.D. Fifth Edition. Loose-Leaf. Paper. Price, \$2. Pp. 293, with illustrations. University Medical Publishers, Post Office Box No. 761, Palo Alto, Calif., 1948.

The fundamental purpose of this edition of this widely used handbook is to provide a terse but clear and comprehensive summary of the diagnostic procedures and factual data which a physician must have quickly available. In addition, much other material is included, including a relatively complete laboratory manual and information regarding the common clinical tests, together with other information which the physician may easily forget. In the present edition there is greater emphasis than before on clinical factors, particularly the significance of abnormal laboratory findings. Simplifications of older tests are also included, such as the "newspaper test" for urinary sulfonamides. Supplemental tables give useful tables of equivalent measurements in the various systems; tables of the chemical elements and their atomic weights; the Greek alphabet and the various uses to which it is put, and the meanings of the commonly used English and Latin abbreviations.

This little vademecum is worth many times its price because of the time that it can save its possessor.

HINDU MEDICINE. By Henry R. Zimmer, Ph.D., Late Visiting Lecturer in Philosophy at Columbia University; Formerly Professor of Sanskrit at the University of Heidelberg. Edited with a foreword and preface by Ludwig Edelstein, Ph.D. Cloth. Price, \$4.00. Pp. 203. The Johns Hopkins Press, Homewood, Baltimore 18, Md., 1948.

Doctor Zimmer delivered the seventh course of the Hideyo Noguchi Lectureship at the Johns Hopkins University in 1940. Three lectures were given. Zimmer began revision of these lectures for publication when his untimely death in 1943 unfortunately left the work far from complete. Doctor Edelstein, however, undertook the difficult task of editing the manuscript left by Zimmer. This task has been well done and no small debt of gratitude is due Edelstein.

In presenting characteristic elements of Hindu

medical tradition through selections from its classics, this work offers an approach to the understanding of the aims and ideals of Hindu medicine, its characteristics, and its possible value for stimulating and enlarging the views of today's medicine. Thus modern medicine may well gain a fresh impulse and insight through reviewing the venerable history of the Hindu discipline.

The book first deals with the oldest Vedic tradition, the medical gods, the literary evidence, the general significance of medicine, the education and career of the physicians, of the hospitals, the implications of medical wisdom, signs and names of diseases. Next the relationship between macrocosm and microcosm is analyzed, the doctrine of the life force and of breath, the theory of the humors and of the body, the teaching of anatomy and physiology are discussed. Thus the book though fragmentary, covers most of the important aspects of Hindu medicine. There is a short comparison of Hindu and Greek medicine.

The general features of Brahmin sacred tradition, its myths, gods, and demons, form an intrinsic part of medical learning. Those who enjoy medical history will find this small volume a fascinating book. It is written in simple lucid language and it is easy to become entranced with its story.

ANATOMY OF THE HUMAN BODY. By Henry Gray, F.R.S. Twenty-Fifth edition, edited by Charles Mayo Goss, M.D., Professor of Anatomy, Louisiana State University School of Medicine, New Orleans. Fabrikoid. Price, \$14.00. Pp. 1478, with 1263 illustrations. Lea & Febiger, 600 S. Washington Sq., Philadelphia 6, 1948.

It seems almost impertinent to attempt to review a book which for ninety years has been known to medical students, practicing physicians, students and professors of anatomy and many other workers in related fields, but the appearance of the twenty-fifth edition of Gray's anatomy merits recording, if only for the purpose of appraising the profession of the fact that the new edition is now available. It is remarkable how the 750 page textbook of the 31 year old lecturer on anatomy has grown and developed with the years and has yet somehow managed to retain the imprint of its originator. Perhaps this is due to the fact that there has been a certain continuity of the editorial boards for the various editions; the six associate editors of the twenty-fourth edition, for instance, have contributed chapters to the present.

The text has been liberally revised to keep it abreast with results of new research, and the illustrations, always an important part of this book, have been worked over to correspond with the text and are better than ever before.

Reflecting the researches of the editor-in-chief, much important material has been incorporated into the portions of the work dealing with the muscles and the fasciae. The bibliographic references have been considerably extended. A notable feature of the book is the better grade of paper than was previously available, making for easier reading and clearer cut illustrations.

PHYSICAL MEDICINE ABSTRACTS

Prescription of Rest in Bed in Infectious Diseases.

J. C. de Wit.

Nederl. tijdschr. v. geneesk. (Jan. 29) 1949.

De Wit discusses the advisability of prescribing rest in bed for patients with internal disorders, particularly for those with febrile diseases. He investigated the incidence of thrombosis and embolism in 1,200 patients, including 300 each in four different age groups. He admits that these groups are too small to arrive at definite conclusions, but he found that in the group of patients over 60 years old, there is a high incidence of thrombosis and of lobar pneumonia and that these and other complications, such as disturbances in bowel function and in retention of urine, are reduced when rest in bed is not continued for prolonged periods. The psychic factor is important in that patients who are allowed to get up earlier usually feel better. The author allows the patient to get up frequently on the second day of an acute infectious disorder, but usually he waits until the temperature has decreased to 39 C. (102.2 F.). He allows the patient to sit up twice a day for fifteen minutes in a comfortable chair, and he advises against the use of the bed pan. On later days he lengthens the periods of sitting up. He compares a group of 1,200 patients treated in this way with the aforementioned group of 1,200. He found that early mobilization reduces considerably the number of thromboses as well as the total duration of the disease, while no disagreeable complications were observed. Early mobilization did not influence the course of the fever. The author advises closer study of the influence of early mobilization in diverse internal anomalies.

Recent Concepts Regarding the Spread and Treatment of Poliomyelitis. Robert B. Lawson.

New England J. Med. 239:994 (December 23) 1948.

Poliomyelitis is a worldwide disease affecting all races and classes of people. It is recognized to be most important as an epidemic disease, however, in North America, the Scandinavian countries, Great Britain and elsewhere in Europe. The main treatment of poliomyelitis is symptomatic and at present is usually some modification of the Kenny technic. The chief differences in the Kenny regimen and so-called "orthodox" treatment are that muscle reeducation, including passive motion of the extremities, is started earlier in the Kenny program; that immobilization is much more complete in the "orthodox" method; and that Miss Kenny treats contractures by application of heat and tendon stretching rather than by corrective appliances. There are many minor variations in the technic of treatment, of course, but it does not seem that many of them are im-

portant. Many different methods of treatment between these two extremes have been used for the past 30 years. Some men carried out a program of treatment very similar to Miss Kenny's for years before her advent. At the present time most medical centers have adopted treatment schemes that are very similar to the Kenny method, without its rigid barriers to modification. It is of interest to compare, if possible, the results of treatment by these various methods. One cannot be dogmatic about such a comparison, for each investigator has a different method of evaluating results. However, a review of all the available articles that include specific figures shows very similar therapeutic results. Mortality rates over the past 30 years have varied, and there has been some variation in end results, but there appears to be no really significant difference in results obtained by the various methods. The first fairly satisfactory statistics from the Kenny Institute fail to prove any superiority for this method of therapy. Lawson, however, would not go back to the period of long immobilization in casts. It does seem that the Kenny method of treatment is more comfortable for the patient and probably makes the recovery of muscle function easier, since the peripheral tissues are kept in better tone.

What Can the General Practitioner Do for the Nervous Patient? W. C. Alvarez.

J. Iowa M. Soc. 39:42 (Jan.) 1949.

Alvarez shows that although the family physician frequently is helped in making a diagnosis by knowing the patient and his background, the average physician does not think often enough of a neurosis. Physicians sometimes fail to recognize a neurosis among their own relatives. The author deplores that professors in medical schools are much too inclined to neglect the neuroses and to demonstrate in the amphitheater examples of only the most rare and bizarre organic diseases. The teacher should remember that his student will rarely, if ever, see or recognize one of these diseases. What they will see every day will be nervous men and women with negative reactions to tests and all sorts of distress everywhere: backaches, headaches, menorrhoea, flatulence, fatigue and lack of energy. One of the bad features of medical practice today is that physicians so often try to diagnose neurosis only by exclusion. A patient is put through all the tests, and if negative reports are obtained, a neurosis is diagnosed. The disadvantage of this procedure is that in tests slight abnormalities may be disclosed which have nothing to do with the illness, but which satisfy the examiner and lead him to conclude that the diagnosis is made; the real disturbance, however, goes on unrecognized and un-

relieved. The author warns against trying to make a diagnosis from one test and against placebos of diagnosis such as low blood sugar, low blood calcium, floating kidney and the like. The way the history is told frequently differentiates the patient with organic lesions from the nervous patients in whom the disorder is functional. The author cites syndromes that are always functional in nature, giving particular attention to migrainous disorders, and to gastrointestinal distress not related to meals or defecation.

Mechanical Aids for Patients with Muscular Disability. Paul Thomas Young.

J. Bone & Joint Surg. 31-A:428 (Apr.) 1949.

The writer has had experience with several cases of a rare form of muscular dystrophy in which there is a generally retarded muscular development. With advancing age and increasing weight, the difficulty of locomotion is augmented. Arising from a chair of ordinary height becomes an arduous task. Going over stairs is laborious. With one patient, if the rise is more than seven inches, the step cannot be mounted without assistance. To aid in meeting these difficulties, various mechanical aids have been evolved, through trial and error over a period of about thirty years. The present report described two forms of secondary aids, stepping-stick canes and self-rising chairs.

The Role of the Sympathetic Nervous System in Acute Poliomyelitis: Preliminary Report. Emil Smith; Philip Rosenblatt, and Andrew B. Lim-auro.

J. Pediat. 34:1 (Jan.) 1949.

The purpose of this paper is to describe clinical observations of the sympathetic nervous system involvement in acute anterior poliomyelitis, to record briefly the presumptive evidence, to present conclusive evidence that angiospasm exists in the acute stage of poliomyelitis and may be responsible for muscle spasm and pain, and to suggest practical methods for relief of pain and spasm.

External application of heat, in all probability, produces vasodilatation both in the chronic poliomyelitic extremity and in the extremity of Raynaud's disease. The improved circulation to the limbs may be responsible for the improved color, feeling of warmth, and diminution of pain and muscle spasm.

Since hot packs were introduced for the relief of muscle spasm and pain, we have steadily looked for a more pleasant and less laborious method to replace it. Short wave diathermy produces clean, comfortable, controlled heat which is easily tolerated. We introduced it to an extremity showing antio- as well as muscle spasm with pain. After treating the extremity for a short period of time the muscle relaxed and the pain diminished or subsided. To bring more blood to a spastic muscle, a rhythmic constrictor was introduced to assist the dilated blood vessels in supplying blood

to the ischemic muscle. Quicker and better results were obtained. The muscles relaxed and the pain diminished or subsided, only to return when the artery or arteriole went back to spasm.

Both hot packs and short wave diathermy produces vasodilatation with relief of muscle pain and spasm. Both methods require trained personnel and are very expensive. We have demonstrated that short wave diathermy with the rhythmic constrictor dilated the blood vessels and increased the blood supply to the extremity. The muscles relaxed and the pain diminished or subsided only to return when the blood vessels contracted. However, we feel that neither short wave diathermy nor hot packs are the solution for the relief of the muscle spasm and pain in acute poliomyelitis, since these methods do not produce sustained vasodilatation. The method of choice would be a drug that could be administered by mouth, subcutaneously, or by the intravenous route.

Treatment of Arthritis. Ralph Pemberton.

Pennsylvania M. J. 52:712 (April) 1949.

The syndrome of arthritis is not as difficult of successful treatment as is usually believed. It is not a disease of joints but a systemic disease with joint manifestations. There is no single curative measure of therapy. The general order of treatment is: rest, systemic as well as local; psychic evaluation; sedation and/or stimulation, never opiates; optimal nutrition in a refined sense, including accessory vitamins if necessary; proper gastrointestinal function; examination of the blood and body chemistry; time for establishment of a general equilibrium; psychic reeducation; examination for foci of infection; medication, such as iron, arsenic, or nux vomica; replacement therapy when indicated; treatment of foci, conservatively; use of physical therapy, conservatively—chiefly heat, gentle massage, postural exercise; orthopedic help, and last, if at all, gold, vaccines, or nonspecific proteins.

The Effect of Ultraviolet Radiation and Air Conditioning Upon the Air Sterility in a Closed Surgery. Julien M. Goodman; Mary B. Cass; Karl P. Klassen, and George M. Curtis.

Surgery 25:284 (Feb.) 1949.

Studies were made in a closed surgery to determine the efficacy of ultraviolet radiation upon the sterility of the air, and the contamination produced by operation of an air-conditioning unit ventilating the room through a small screen grid 17½ by 8 inches, located 7 feet above the floor in the middle of one of the side walls just above an ultraviolet lamp. Studies of the degree of contamination at floor level and at operating-table level were made. Classification of air and skin contaminants as well as of molds was made and the resultant percentages tabulated.

Air conditioning without any means of filtering the inlet increases the air contamination in a closed room. The contamination at various levels in a room is not appreciably affected by air conditioning. Ultraviolet radiation in a closed

room exerts a beneficial effect on the relative sterility of the air by reducing the quantity of air contaminants equally at all levels. It is possible that by a finer screening device, or by the use of ionization further to cleanse the air before it is injected into a room, the contamination might be still further lessened.

Primer on the Rheumatic Diseases: Part II. Prepared by a Committee of the American Rheumatism Association.

J. A. M. A. 139:1139 (Apr. 23) 1949.

Muscular weakness and atrophy are prominent in rheumatoid arthritis and in some cases constitute the most striking features. Atrophy usually is particularly noticeable in the muscles of the hands, but it also occurs in all the muscles of the extremities and contributes to the fusiform appearance of the joints. In the opinion of the majority of observers the muscular atrophy is an integral part of the disease and is not solely attributable to the two known factors, disuse and muscular malnutrition, associated with persistent contraction. Rest probably is the most important single measure in the treatment of this disease, rest for the body as a whole and rest for the inflamed joints in particular. It is never necessary to prescribe absolute bed rest. Even in the case of most severe disease, mild muscle setting exercises should be prescribed and should be increased as the patient improves.

Physical therapy and spa therapy are useful for many types of arthritis. Baths and exercises in warm pools are sometimes helpful. Heat in the form of poultices, melted paraffin baths, baking lamp or diathermy often is comforting but is not curative. In fact, in the case of acute disease, local heat sometimes is not well tolerated. The most useful forms are simple measures such as the application of heat and muscle exercises which can be performed at home daily by the patient after a minimum of instruction. Violent massage and strenuous passive exercises are poorly tolerated, and all such therapy should be confined within limits of pain and fatigue. Occupational therapy can be of great assistance in awakening the patient's interest in exercising important groups of muscles.

Degenerative joint disease is a common articular disorder that has been variously named osteoarthritis, hypertrophic arthritis, senescent arthritis and by certain European writers, arthritis deformans. The most rational therapeutic measures are those providing rest for the affected part. The means to insure this should be applied to the individual joint with a view to its peculiar stresses in weight-bearing and motion. In the case of a peripheral articulation of the upper extremity, simple splinting usually is sufficient. In joints of the lower part of the spine, legs and feet, additional measures to relieve strain and weight-bearing may be necessary. Support to various parts may be provided by strapping, belts, braces or by the use of canes or crutches. For more severe degenerative disease of the hips and lower part of the spine, rest in recumbency with or with-

out traction may be required. Physiatric measures are valuable in the correction of malpostures which act as contributory factors and in the treatment of degenerative joint disease. During especially painful phases such measures should be confined to applications of heat in a simple form, preferably not soaks, hot towel packs or infrared light, accompanied by stroking massage of the periarticular tissues and muscles. After a few days, when the lesion has become quiescent, passive motion should be added before a gradual return to active exercises and normal function. Roentgen therapy has been advocated for the relief of pain, but its benefit is unproved and its use for this purpose in degenerative joint disease unjustified when satisfactory relief can be obtained by safer means.

Primer on the Rheumatic Diseases: Part III. Prepared by a Committee of the American Rheumatism Association.

J. A. M. A. 139:1268 (Apr. 30) 1949.

Primary fibrositis may be rather generalized or sharply localized. The more disseminated form of the illness involves the fascia, tendons and aponeuroses particularly in the back, shoulders, thighs and hands, although all other fibrous tissue may be prominently affected. The cause is unknown. The same uncertainties surround the nature of this rheumatic disease as exist for rheumatoid arthritis. In some instances acute infections, trauma, unusual physical activity, fatigue and exposure to dampness and cold appear to be contributory causes. Treatment of fibrositis is supportive and symptomatic. Avoidance of strenuous physical activity and procurement of additional daytime rest are wise, but it is a mistake to avoid ordinary activity, and moderate recreation often is advantageous. Mild exercise usually greatly aids limbering up and relieves stiffness and aching, whereas prolonged or severe exercise usually increases discomfort. Heat often relieves; massage which gradually is made rather firm usually is helpful and planned exercise done after application of heat commonly relieves stiffness and aching. Hot packs are usually helpful for acutely painful episodes. Fibrous tissue irritation or inflammation may be rather localized. Symptoms and disorders of function depend on the anatomic localization. Inflammation of a bursa is a common form of localized fibrositis. One of the most difficult problems is fibrositis about the shoulder, which is much more frequent than arthritis of the shoulder joints and often begins with subacromial bursitis. Acute subacromial bursitis may be mild or severe. It is characterized by pain and tenderness usually localized to the subacromial region, made worse by allowing the arm to hang unsupported, by pressure over the tip of the shoulder or by movement of the shoulder in abduction and rotation. Sometimes these motions are markedly restricted by severe pain. Treatment should be directed to relieving the pain, maintaining function and reassuring the patient as to the relatively mild nature of the disease. Local application of radiant heat or diathermy may re-

lieve, but often aggravates pain, in which case cold usually relieves. Rest during the more acute phase followed by graded exercises to restore motion is helpful.

The shoulder-hand syndrome is an interesting and incompletely understood form of nonarticular rheumatism. It may follow myocardial infarction or painful intrathoracic lesions, vascular accidents, trauma or other irritative lesions about the neck or upper extremity and sometimes without known cause. After weeks or months atrophy of the shoulder and hand occurs and adhesions or contractures limit motion in the affected parts. This syndrome is thought to be a reflex dystrophy. It needs to be differentiated from rheumatoid arthritis. Treatment with usual measures of physical therapy and analgesics often is without benefit. If stiffness of shoulder or hand results, occupational and physical therapy may rehabilitate.

Notes of Experiments Illustrating Normal Temperature Regulation in Young Men. Samson Wright.

Brit. M. J. 4605:610 (April 9) 1949.

It has been the custom for some years in the department of physiology for our students to carry out a series of experiments which illustrate some of the more important facts about body temperature and its regulation in man. The experiments are conveniently performed during the vacation in the student's own home, as they require no special apparatus but do need a good deal of time and access to a bathroom. In this paper brief particulars are given of these experiments for the benefit of teachers who might care to use them. Some illustrative results are also shown graphically; most readers may find these graphs more instructive than a statistical analysis of the results. All the observations on which this report is based were carried out on healthy young men during the summer vacation; the readings are given in F. degrees. Simple experiments are described which illustrate the more important facts about normal temperature and its regulation in man. Attention is drawn to the undesirability of having a mark on clinical thermometers opposite the 98.4 F. (36.9 C.) level, and of inscribing clinical thermometers with the words "half-minute" or "two minutes."

Treatment of Acute Stage of Anterior Poliomyelitis (Study on Use of Curare). M. E. Pusitz. J. Kansas M. Soc. 50:1 (Jan.) 1949.

Pusitz treated 104 consecutive cases of acute infantile paralysis in the epidemic of 1946. Twelve cases of mild disease were treated in the home. In this group neostigmine was used alone with fair effect in relieving pain and muscle spasm. Of the 92 hospitalized patients, 14 were treated with hot packs; 3 of these were effectively treated with hot packs alone; 2 had neostigmine added to obtain relief. In 3 cases of hot packs and neostigmine the relief was not adequate, but immediately became adequate when the patients were switched to curare therapy alone. In 6 cases hot

packs were not effective enough and so the patients were immediately transferred to treatment with curare alone without neostigmine. All obtained immediate relief with curare. Curare was used in a total of 53 cases. The drug was administered intramuscularly three times daily, starting with a minimum dose of 0.9 unit of in-tecostrin per kilogram of body weight, and increasing gradually until an effective dose was reached, never more than 1.5 units. In no case did curare fail to relieve pain to the major extent, and the same was true for muscle spasm. There was absolutely no residual paralysis in 57 of the hospitalized and in 11 of the nonhospitalized patients. There were 6 deaths; 6 cases of involvement of the upper extremities, and in only 1 of these was there residual paralysis of the deltoid. Of 17 patients with braces, 4 discarded the braces within four months. Thirteen were still using braces in November, 1947. Two were seriously paralyzed with involvement of the upper and lower extremities. No true scoliosis has appeared and all contractures have so far been adequately taken care of.

Swimming Is Healthful, But — Do's and Don'ts for Instructors. Charles LeRoy Lowman.

Crippled Child. 26:7 (Apr.) 1949.

Organized courses are now being held for almost every type of physically handicapped person by many large public and private health organizations. The many considerations which are necessary for this particular hydrotherapy compel the instructor to think of each participant individually, and not only allow him to do all he can, but protect him from overexercising. Instructors who teach the physically handicapped must at all times bear in mind the importance of restraining overactivity as well as limiting the use of strong muscles to the neglect of others that would most benefit. Carrying the physical types in mind as a primary classification, the director will face the distinctions that must be made for the varying types of handicapped persons he will instruct. Polios and the cerebral palsied make up two major groups whose different pathologic characteristics must be considered.

It is obvious that all persons responsible for the handicapped — both in and out of water — have legal responsibility towards their pupils. Activities in the water, not without danger for normal persons, are, in the nature of things, more dangerous for the handicapped. Continuous alertness and care on the part of instructors, counselors and leaders are of paramount importance. The fine efforts put forth by organizations aiding the handicapped should receive every possible safeguard. Counselors and directors should have clearly in mind the actual pathologic differences of polios, the cerebral palsied, and other handicapped persons in their care. They must understand physiologic reactions thoroughly in order to do good rather than harm. Enthusiasm for play response, morale boosting or other psychologic values, should not be emphasized at the expense of other health and development needs.

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Name of Hospital	Location	Chief of Service	Inpatients Treated	Number of Treatments	Asst. Res. & Residencies Offered	Beginning of Service (1949)	Beginning Stipend (Month)
United States Army							
†Letterman General Hospital★	San Francisco	A. E. White	14,163	207,661	2	.....	n
†Fitzsimons General Hospital★	Denver	H. B. Luscombe	20,370	240,636	2	.....	n
Walter Reed General Hospital★	Washington, D. C.	E. M. Smith	6,849	174,225	1	1, 7	n
Veterans Administration							
†Veterans Admin. Hospital ¹	Ft. Logan, Colo.	C. C. Hoffman	2,875	48,162	1	.....	n
Veterans Admin. Hospital	Chamblee, Ga.	G. D. Williams	1,905	37,824	1	7/1	n
†Veterans Admin. Hospital	Hines, Ill.	L. B. Newman	12,600	486,539	7	.....	n
Veterans Admin. Hospital ¹	New Orleans, La.	S. Winokur	928	35,356	1	7/1	n
Veterans Admin. Hospital ¹	Framingham, Mass.	.....	3,008	94,543	2	.....	n
†Veterans Admin. Hospital ¹	Jefferson, Mo.	.....	1,141	75,519	1	.....	n
†Veterans Admin. Hospital	New York City	H. Kessler	5,612	290,091	3	.....	n
†Veterans Admin. Hospital ¹	Cleveland, Ohio	H. T. Zankel	14,030	142,719	1	.....	n
†Veterans Admin. Hospital	Portland, Ore.	E. W. Fowles	4,078	95,079	1	1/1, 7/1	n
†Veterans Admin. Hospital	Aspinwall, Pa.	S. Machover	1,919	61,934	1	7/1	n
Nonfederal							
Los Angeles County Hospital★ ¹	Los Angeles	.....	.....	114,657	1	Varies	\$165.00
†White Memorial Hospital★	Los Angeles	F. B. Moor	231	.....	1	7/1	140.00
Stanford University Hospitals★ ¹	San Francisco	W. H. Northway	.....	7,445	2	7/1	50.00
University of Colorado Medical Center	.....	.....	.....	.....	.....	.....	.....
†Colorado General Hospital★ ¹	Denver	H. L. Dinken	2,320	49,307	1	7/1	75.00
†Emory University Hospital★	Emory Univ., Ga.	R. Bennett	9,564	22,721	1	7/1	.....
†Georgia Warm Springs Foundation	Warm Springs, Ga.	.....	.....	.....	.....	.....	.....
Michael Reese Hospital★	Chicago	C. O. Molander	2,678	25,219	2	.....	25.00
†Passavant Memorial Hospital★	Chicago	.....	12,403	34,155	1	.....	.....
University of Kansas Medical Center★	Kansas City, Kan.	D. L. Rose	7,452	27,094	3	.....	.....
†Massachusetts General Hospital★	Boston	A. L. Watkins	.....	.....	2	.....	.....
†University of Minnesota Hospital★ ¹	Minneapolis	M. Knapp	8,018	12,580	2	.....	.....
Mayo Foundation	Rochester, Minn.	F. H. Krusen	.....	.....	2	.....	92.50
†Bellevue Hosp., Div. III - N. Y. Univ.★	New York City	H. Rusk	35,406	63,198	1	.....	60.00
†Goldwater Memorial Hospital★ ¹	New York City	H. Behrend	950	69,483	1	7/1	70.00
†Hospital for Joint Diseases★ ¹	New York City	J. Weiss	62,567	87,314	2	1/1	40.00
†Hospital for Special Surgery	New York City	.....	.....	.....	.....	.....	.....
†Montefiore Hosp., for Chronic Diseases★	New York City	K. Harpuder	1,597	25,500	1	.....	50.00
†Mount Sinai Hospital★	New York City	W. Bierman	2,610	57,705	1	.....	50.00
†Presbyterian Hospital★	New York City	W. B. Snow	71,514	198,791	1	.....	41.66
St. Luke's Hospital★	New York City	R. Muller	24,412	95,718	1	7	50.00
†Rehabilitation Hospital ¹	W. Haverstraw, N.Y.	M. Hoberman	415	237,356	1	.....	.....
†Cleveland Clinic Hospital ¹	Cleveland	W. J. Zeiter	16,060	37,691	1	7/1	100.00
†Hospital of the Univ. of Pennsylvania★ ¹	Philadelphia	G. M. Piersol	1,106	14,557	1	Varies	.....
†Medical College of Virginia, Hosp. Div.★	Richmond, Va.	W. J. Lee	5,047	31,453	1	7/1	46.50
†State of Wisconsin General Hospital★	Madison, Wis.	H. D. Bouman	1,988	18,291	2	.....	.....

The star (★) indicates hospitals that are also approved for the training of interns. All hospitals on the approved intern list are likewise accredited for general residencies which represent general house staff assignments following the internship.

The dagger (†) represents temporary approval, pending formal inspection, in accordance with the plan for the temporary approval of residencies in specialties as announced in THE JOURNAL, A. M. A., March 2, 1946, p. 586.

n Indicates that the salary is established by government pay tables.

¹ Represents residencies open to women.

*** Rep. in part J. A. M. A. 140:205 (May 14) 1949.

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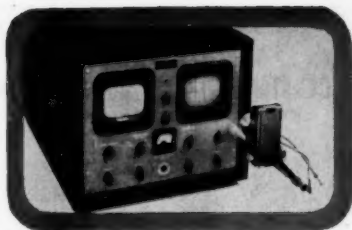
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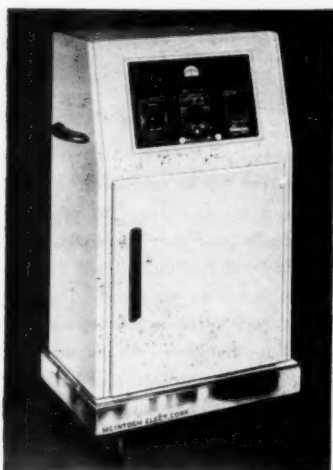
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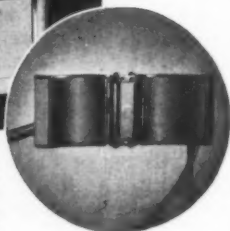
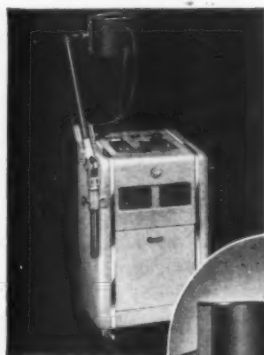


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